

ROADMASTERS' CONVENTION NUMBER

Railway Maintenance Engineer

me 13

CHICAGO: Transportation Building
NEW YORK: Woolworth Building

OCTOBER, 1917

CLEVELAND: Citizens' Building
WASHINGTON: Home Life Building

Number 10



A Chain is
No Stronger
than its
Weakest Link

—a Rail is
No Stronger
than
The Joint

BONZANO-THOMSON RAIL JOINT

The Joint is Strong as the Rail
Millions in Use Without a Single Failure

The Q^{AND} C Co.



FROGS = SWITCHES = STANDS

Manganese and Built-Up Construction

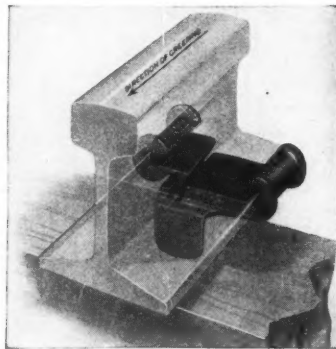
IN STOCK for IMMEDIATE SHIPMENT

THE INDIANAPOLIS SWITCH & FROG COMPANY

NEW YORK

SPRINGFIELD, OHIO

CHICAGO



THE P. & M.

RAIL ANTI-CREEPERS

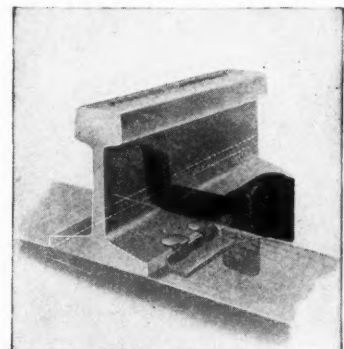
**EFFECTIVE — EFFICIENT
UNIVERSALLY USED**

THE P. & M. CO.

RAILWAY EXCHANGE
CHICAGO

NEW YORK
ST. PAUL

SAN FRANCISCO
DENVER



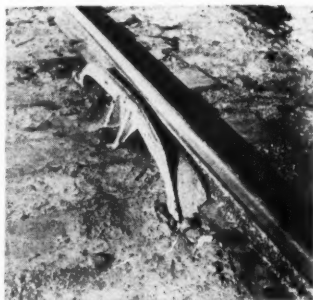
THE VAUGHAN

ESTABLISHED 1882

THE WEIR FROG CO.

*Track Work of Rail and
Manganese Steel Construction*

CINCINNATI --- --- --- --- OHIO



Note the foot guard and the wearing insert. Weight 80 lbs.

Tailor Made GUARD RAILS

To suit your special requirements,
for less money than you are now paying.

WRITE FOR CATALOGUE

National Steel Products Co., Inc.

Ensley, Alabama

Ramapo

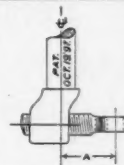
MANGANESE TRACK
WORK A SPECIALTY

AUTOMATIC SAFETY SWITCH STANDS

1. **POSITIVE THROW.**—Ramapo Safety Switch Stands are rigid for hand operation. The operator raises the handle, thereby releasing the spindle from the automatic mechanism, then throws the switch, but cannot lower the handle or relock switch unless the points are fully thrown.
2. **AUTOMATIC SAFETY FEATURES.**—A train or car can trail through a switch when set wrong, locked with a Ramapo Safety Switch Stand, without breaking the switch points or injuring the switch stand. The first pair of wheels forces the switch points open, compressing springs in the switch stand, and when points are half way thrown the springs snap the points the rest of the way. The stand is left locked in new position, just as if thrown by hand, and is again ready for either hand or automatic operation.
3. **ADJUSTABLE FEATURES.**—All Ramapo Safety Switch Stands are furnished with adjustable throw and adjustable moving-rods, unless otherwise ordered. Adjustable switch rods are not required, as either switch point can be adjusted. The throw can always be adjusted to suit that of any switch, one-half turn of the eye-bolt crank affecting the throw one-twelfth of an inch. See table of crank adjustments below. The distance of stand from switch can be readily adjusted with the adjustable moving-rod without moving the stand on the ties.

CRANK ADJUSTMENTS FOR RAMAPO SAFETY SWITCH STANDS

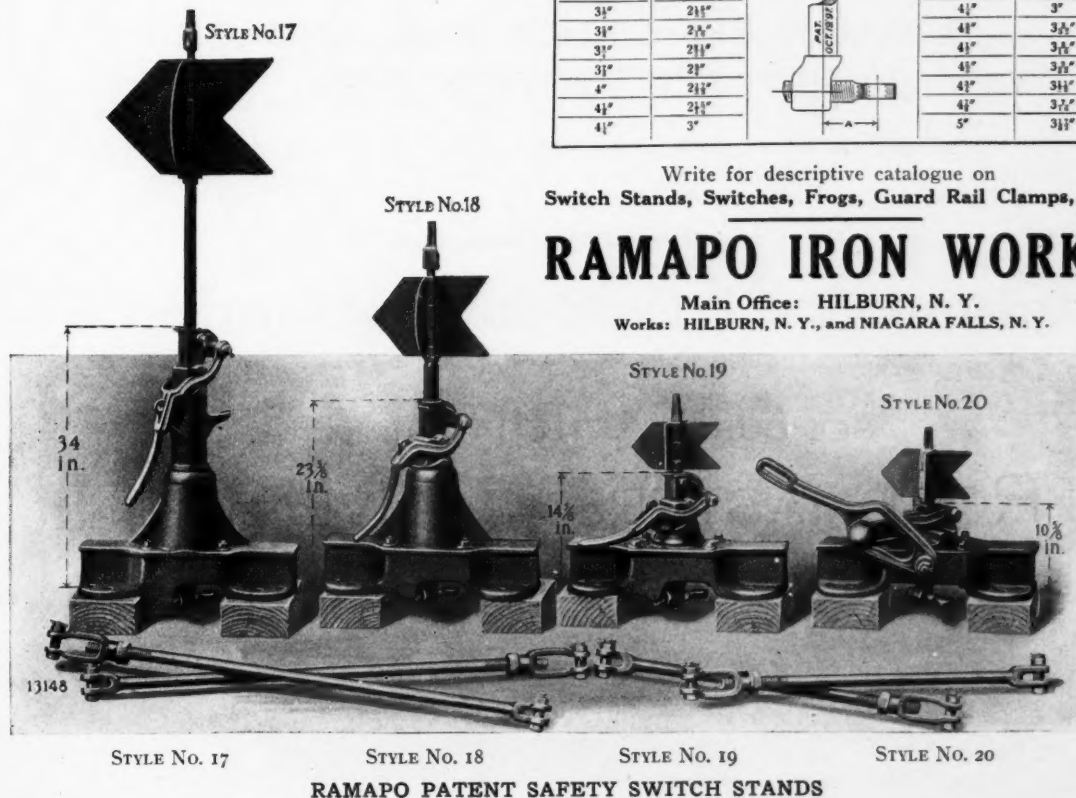
THROW OF STAND	"A"	THROW OF STAND	"A"
3½"	2½"	4½"	3"
3½"	2½"	4½"	3½"
3½"	2½"	4½"	3½"
3½"	2½"	4½"	3½"
4"	2½"	4½"	3½"
4½"	2½"	4½"	3½"
4½"	3"	5"	3½"



Write for descriptive catalogue on
Switch Stands, Switches, Frogs, Guard Rail Clamps, etc.

RAMAPO IRON WORKS

Main Office: HILBURN, N. Y.
Works: HILBURN, N. Y., and NIAGARA FALLS, N. Y.



ANNOUNCEMENT

THE ANTI-CREEPER CORPORATION

26 CORTLANDT STREET, NEW YORK, N. Y.

IS SALES AGENT FOR

DINKLAGE CREEPCHECK
BOWMAN EFFICIENCY RAIL ANCHOR
METCALF ANTI-CREEPER

SEE OUR EXHIBIT DURING THE
ROADMASTERS' CONVENTION
SPACE 33-41 AUDITORIUM

STOP!

Your Crossing Frog Bolt Breakages

*If you remedy this difficulty you have the answer
for Minimum Crossing Maintenance*

INTERNATIONAL STEEL CROSSING FOUNDATIONS

Insure this Result

This claim is not theoretical or a guess, but it has been demonstrated in the past five years at several hundred installations under the heaviest service. These steel foundations maintain line and surface, and prevent creepage. That's how they solve the bolt breakage problem.

Add about 50% to the cost of your built up crossing frog, buy an International Steel Crossing Foundation and double the life of the frog. These foundations also cut maintenance. Ask the users if you want our best sales argument.

Write us today for a quotation. Send us your crossing frog details and we will quote by return mail.

Prompt Deliveries Made from Stock

The International Steel Tie Company

Manufacturers of Steel Twin Ties and Crossing Foundations

General Sales Office and Works: Cleveland, Ohio

REPRESENTATIVES

Western Eng'g Sales Co.,
Los Angeles, Cal.

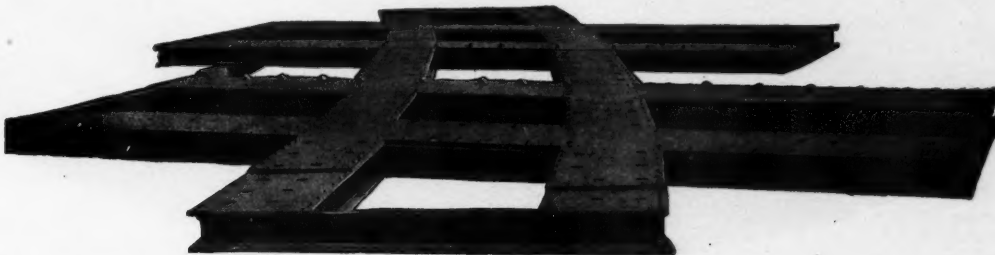
San Francisco, Cal.
Seattle, Wash.

R. J. Cooper Co.,
Salt Lake City, Utah

J. E. Lewis & Co.
Dallas, Texas.

Maurice Joy,
Philadelphia.

William H. Ziegler,
Minneapolis, Minn.



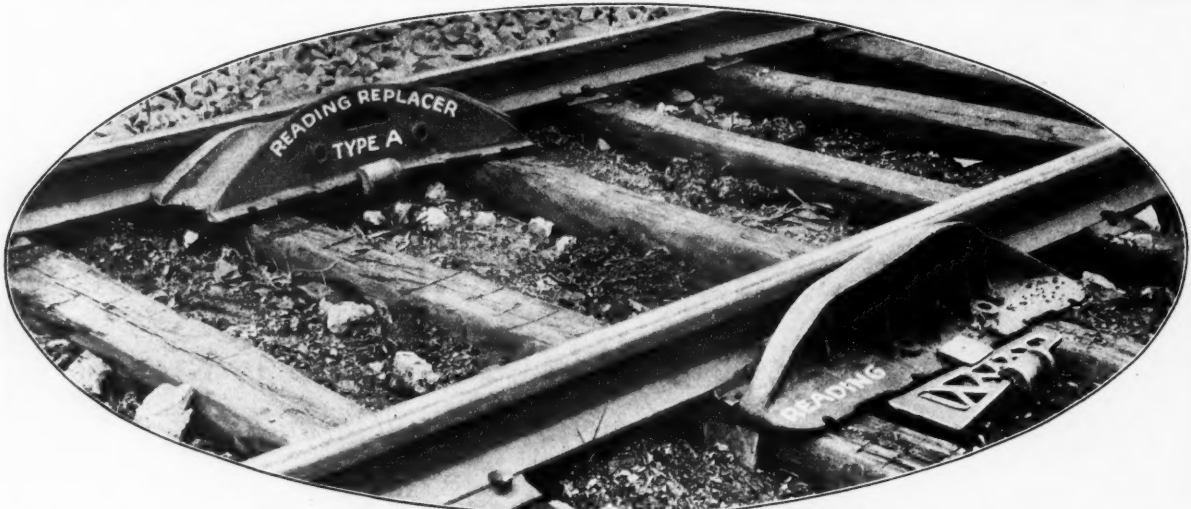


Illustration above shows Reading Car and Engine Replacer Type A, for 60,000 lbs. axle load. Note the Reading Clamp. No spiking required.



Illustration above shows Reading Car and Engine Replacer Type A-1 side the rail for 75,000 lbs. axle load. Note the Reading Clamp. No spiking required.

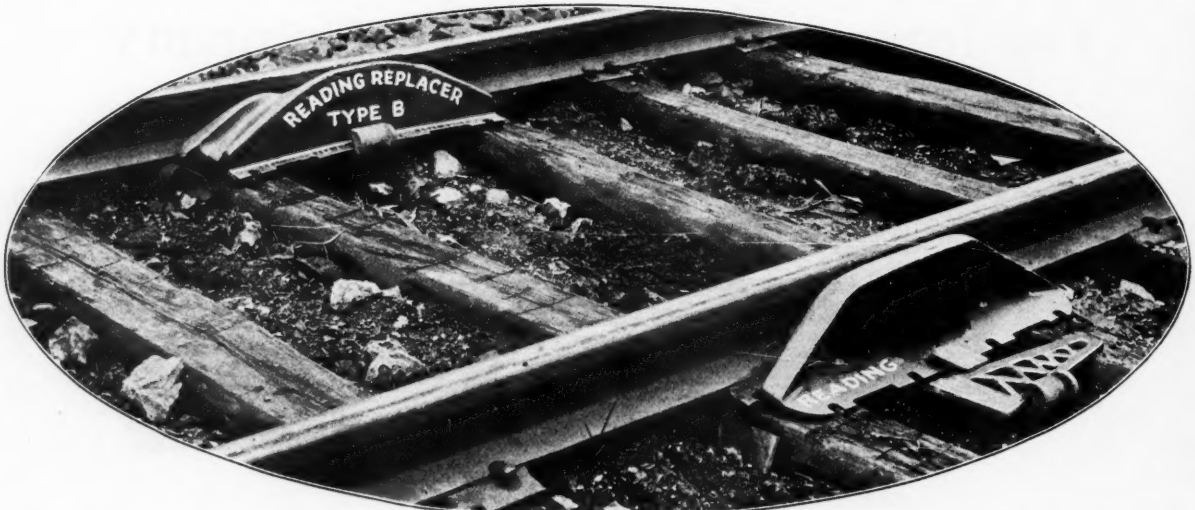
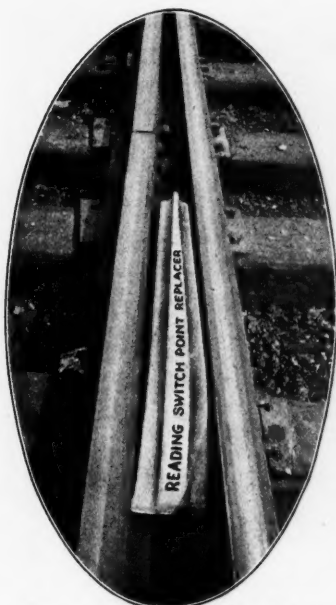
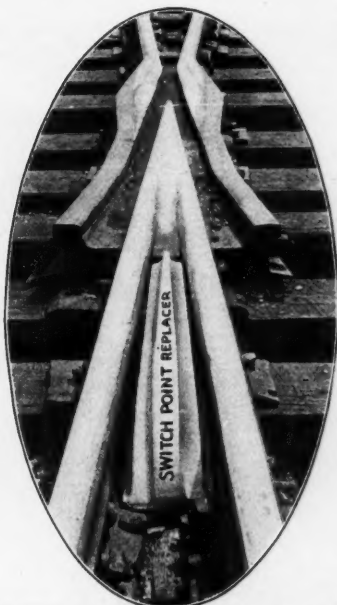


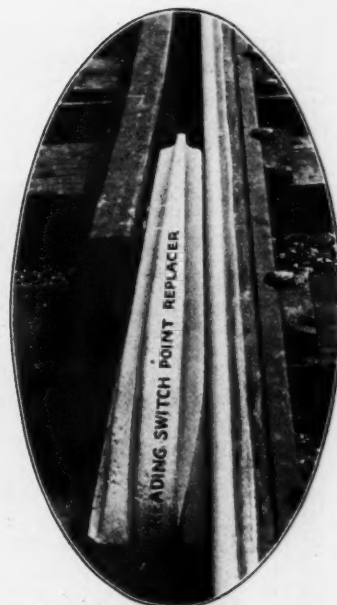
Illustration above shows Reading Car and Engine Replace Type B for 40,000 lbs. axle load. Note the Reading Clamp. No spiking required.



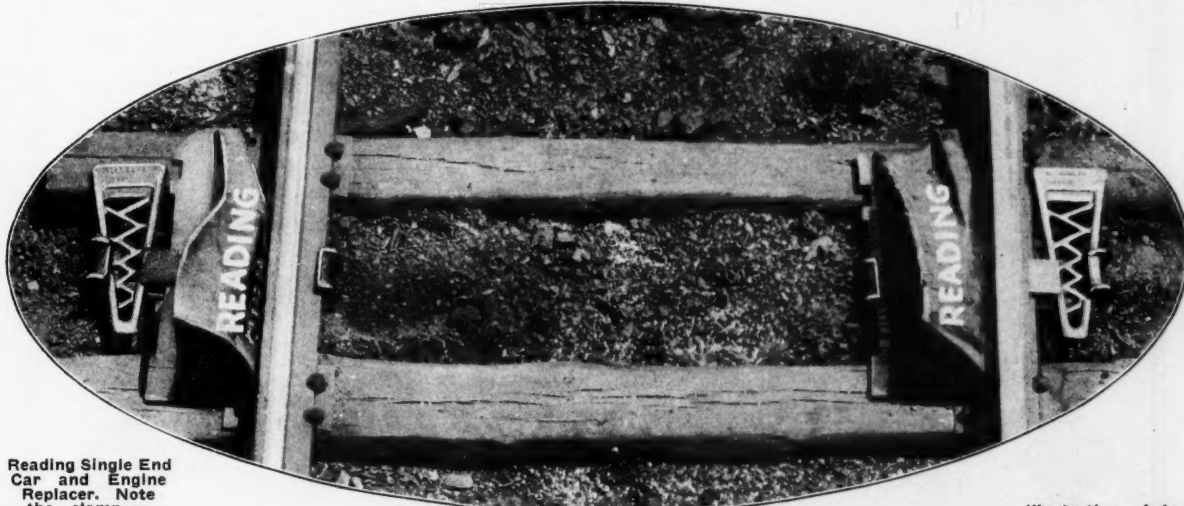
Reading Switch Point Replacer.



Reading Switch Point. Frog and Guard Rail Car and Engine Replacer.



Reading Switch Point Replacer, for Frog & Switch Use.



Reading Single End Car and Engine Replacer. Note the clamp — no spiking required.

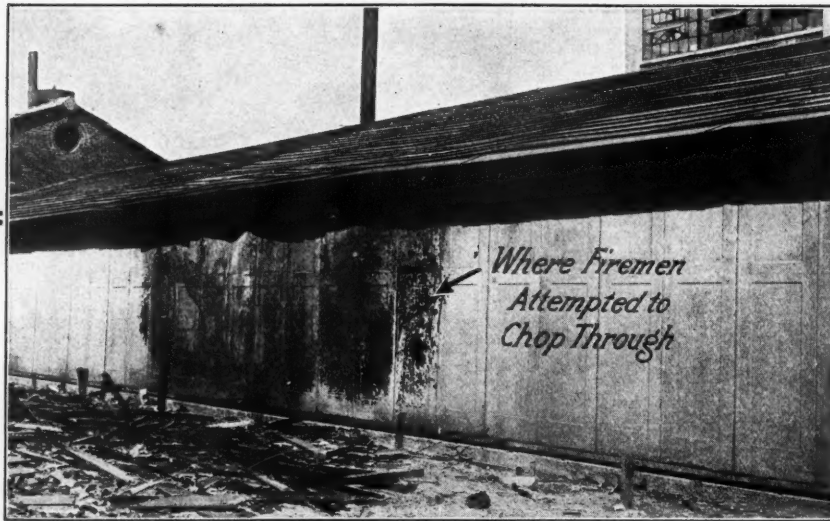
Illustration below shows the Reading Spread the rail replacer.



BRANCH OFFICES
1st National Bank Bldg.,
Denver, Colo.
982 Oliver Bldg.,
Pittsburgh, Pa.
H. W. Hellman Bldg.,
Los Angeles, Cal.

Manufactured and Sold by **The Reading Specialties Co., Reading, Pa.**
Manufacturers of Guard Rail Clamps, Rail Benders, Tie Spacers and Compromise Joints

BRANCH OFFICES
111 Broadway, N. Y.
747 Railway Exchange,
Chicago, Ill.
4th National Bank Bldg.,
Atlanta, Ga.
Colorado Bldg.,
Washington, D. C.



After fierce fire at Joseph N. Smith Co.'s plant, Detroit. Contents of Truscon Steel Building uninjured.

It Withstood the Fire and Saved the Contents

The outside of this warehouse of the Joseph N. Smith Company was piled high with lumber from a recent construction job. A fierce fire lasting approximately an hour destroyed the lumber. In the midst of the flames and intense heat stood the Truscon steel warehouse. The inflammable contents of the building were unharmed.



are fireproof. They are built of heavy gauge steel panels that successfully resist time and the elements. Built of interchangeable panels, these buildings can be secured in practically any desired length or width and any arrangement of windows and doors. Every part of the building is of steel—steel doors, steel sash, steel roof, steel trusses—a substantial construction, permanent and weathertight.

In addition, these buildings are portable. They can be readily taken down and re-erected in a new location without loss or depreciation. Truscon Steel

Buildings are quickly erected, as they are shop-made and the panels are readily united with our improved wedge bolt. No riveting or bolting required.

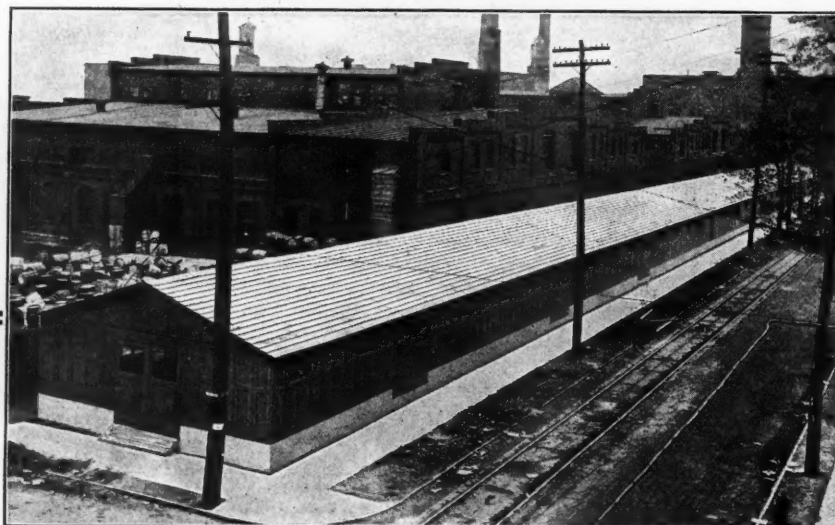
For factories or shops, warehouses, hospitals, storage, kitchens, laundries, garages and all places requiring permanent buildings quickly, Truscon Steel Buildings are unsurpassed. The cost is far less than other forms of fireproof construction. The time saved and the fact that the building can be used over and over again are important economies.

Write for catalog and suggestions. Our staff is at your disposal to help solve your building problems

STEEL BUILDING DEPARTMENT

TRUSSED CONCRETE STEEL COMPANY, YOUNGSTOWN, OHIO

Representatives in Principal Cities



Warehouse 28 ft. x 440 ft., Parke, Davis & Co., Detroit, Mich. Another Truscon Steel Building.



The Cheapest Large Capacity Deep Well Pump When All The Costs Are Considered

The ability to deliver most water from a deep well at lowest total cost, when all first costs, attendance costs and upkeep costs are considered, is the quality that is creating the demand for the "American" Deep Well Turbine Centrifugal Pump.

It will deliver a far larger quantity of water from a deep well of a given size than any other type of pump, except the air lift, and will maintain a much higher efficiency than any air-lift system in existence.

This pump is very compact in design, requires little attendance, and can be relied upon to meet every requirement of water-supply service.

The accompanying illustrations show an installation of one of these pumps in the City Waterworks of Morris, Illinois. Note the small space occupied by the pump and the small size of the pump house.

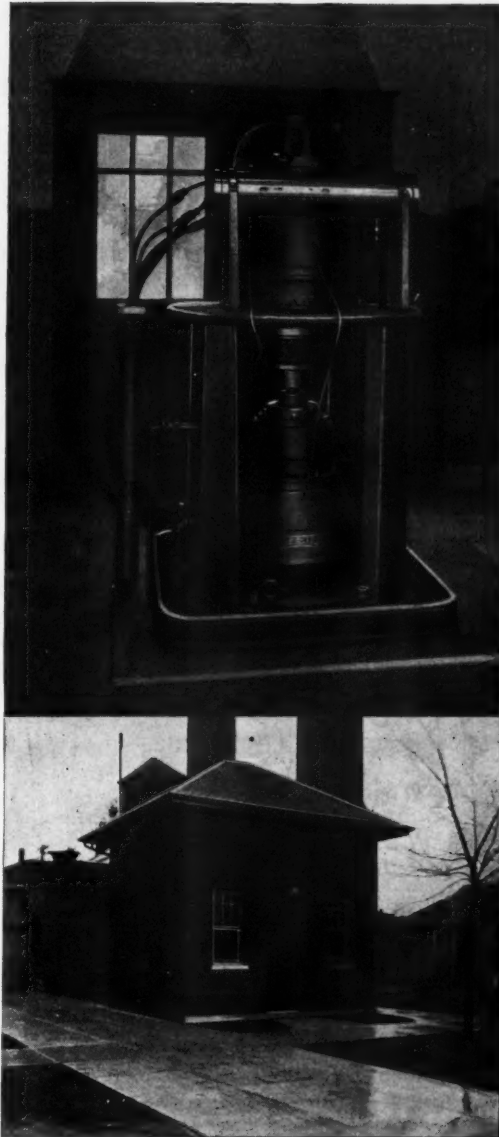
The pump is a 15-inch, six-stage turbine with the bowls located 190 feet below the surface, and has a 40-ft. suction pipe attached below the bowls. Pump is direct connected to a 37½-h.p. vertical type Lincoln Electric, 3-phase, 60-cycle, 220-volt, slip-ring motor and operates at a full-load speed of 1,150 r.p.m.

This pump is designed to deliver 400 g.p.m., against a total head of 185 ft., and discharges into a reservoir from where the water is pumped into the mains by other equipment. A careful test of this pump shows that it maintains an efficiency of 66 per cent.

Consider the small size of this pump and then note the quantity of delivery, the high head and the efficiency maintained.

Meeting successfully the most difficult pumping conditions is what is building the reputation of this turbine.

**Catalog 132 describes it.
Write for it.**



The American Well Works

General Office and Works: Aurora, Ill.
Chicago Office: First National Bank Bldg.

Sales Agencies:

New York City.
Philadelphia, Pa.
Pittsburgh, Pa.
St. Paul, Minn.
St. Louis, Mo.

Birmingham, Ala.
Kansas City, Mo.
Joplin, Mo.
Lincoln, Nebr.
Denver, Colo.

San Francisco
Salt Lake City
Los Angeles
Dallas, Texas
Artesia, N. Mex.

Edmonton, Alta.
Calgary, Alta.
Chatham, Ont.
Montreal, Que.



Longer Life—durability and rust resistance—is assured from Keystone Copper Steel products.

When this alloy steel is used for Galvanized Sheets, Culvert Stock, Black Sheets or Terne Plates, the *Keystone* is added below the regular brands. Shall we send latest booklets?

American Sheet and Tin Plate Company

General Offices: Frick Building, Pittsburgh, Pa.

DISTRICT SALES OFFICES:

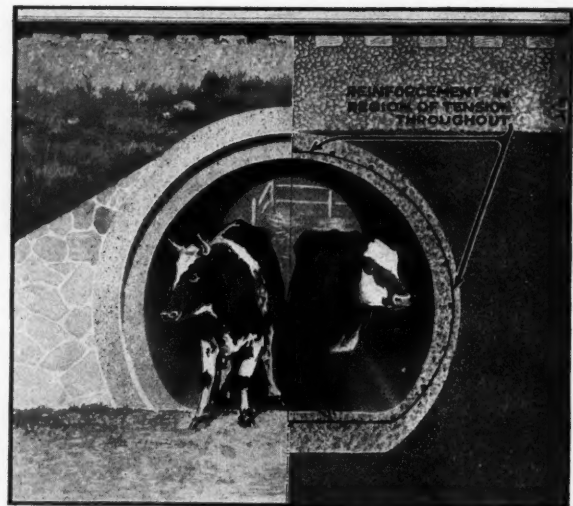
Chicago Cincinnati Denver Detroit New Orleans New York Philadelphia Pittsburgh St. Louis
Export Representatives: UNITED STATES STEEL PRODUCTS COMPANY, New York City
Pacific Coast Representatives: UNITED STATES STEEL PRODUCTS COMPANY, San Francisco, Los Angeles, Portland, Seattle

Massey Concrete Cattle Pass

Here's a point of superiority you engineers will recognize—only in the Massey cattle pass is the reinforcing placed in the region of tension throughout. The cross-section illustrates this big advantage. The strength it adds should be considered when you are contemplating the installation of cattle passes.

The Massey cattle pass is made up at our factories in units 6' long, 84" wide by 72" high inside. Two head of cattle pass through side by side. A flat bottom gives them broader footing.

The Massey pass is built to carry the dead load in deep fills, and live loads when placed within about 3' of the base of the rail. It is more economical than any other type of structure, and requires absolutely no maintenance.



Massey factories make concrete culvert pipe, 12" to 84" in diameter, concrete bridge slabs, piles, and portable concrete houses. Our plant locations and large stock of standard products enable us to make prompt deliveries at low freight rates.

Get Massey Service with Your Cattle Pass

C. F. MASSEY COMPANY

NEW YORK
NORFOLK

KANSAS CITY

Peoples Gas Building
CHICAGO

MINNEAPOLIS

SPOKANE
DALLAS

Factories Located at

Newark, N. J.
Chicago, Ill.

Memphis, Tenn.
Anna, Ill.

Youngstown, Ohio
Los Angeles, Cal.

Kansas City, Mo.
Meridian, Miss.

Minneapolis, Minn.
Spokane, Wash.

Dallas, Tex.
Chatham, Ont., Can.

Save time in filling your tenders Prevent damage from Water Hammer



WITH THE
**POAGE Style H
WATER
COLUMN**

An Instantly Adjustable Spout

Quicker work in filling tender tanks is possible with the Poage Style H. Water Column equipped with the Fenner drop spout. The spout works equally well with tenders of different heights.

A vertical range of five feet and a lateral range of three feet make accurate spotting of the tender unnecessary.

The spout avoids the usual winter troubles in cold climates. It has a non-freezable telescopic joint. This is entirely open. There is no packing of any sort. Yet it does not leak or waste a drop of water.

Quick Closure Without Water Hammer

Even on high pressure water mains, the Poage Style H. Valve is closed quickly without danger to the mains from water hammer. The flow is cut down 85 per cent very rapidly and the remaining 15 per cent more slowly.

Tests by the University of Illinois have shown that this principle provides the quickest closure and makes water hammer impossible.

Investigate the Poage Style H. water column. Give it a thorough trial.

Manufactured exclusively by

The AMERICAN VALVE & METER CO.

Cincinnati, Ohio

Try the Distillation Test

to demonstrate the difference between the creosote oil you are now using and **Reilly's Improved** (Permanent) **Creosote Oil**—Patented.

Treated ties rapidly give way after the oil has evaporated or leached out of the wood. Therefore the value of any oil for treating ties depends solely upon the amount of permanent constituents.

Reilly's Improved (Permanent) **Creosote Oil**—Patented—contains not less than three times as much permanent body as the next best grade. At 250 degrees C. less than 1% distills. At 315 degrees C. more than 75% remains. If your present creosote oil shows 25% remaining at this temperature, it is better than the average oil on the market—and but one-third as valuable as **Reilly's Improved** (Permanent) **Creosote Oil**—Patented.

Our oil not only coats the fibres, but it fills the cells and interstices with a solid mass of impermeable oil. **It stays in the wood forever.**

Samples will be gladly submitted and we can make prompt quantity shipment from any of our refineries.



Reilly's Wood Preservative Oil

(Patented)

is our best product for open tank or brush treatment. A high-boiling anthracene oil—limpid and free-flowing at working temperatures. Contains no adulterant or volatile products.

Send for Sample

Republic Creosoting Company

Indianapolis, Indiana

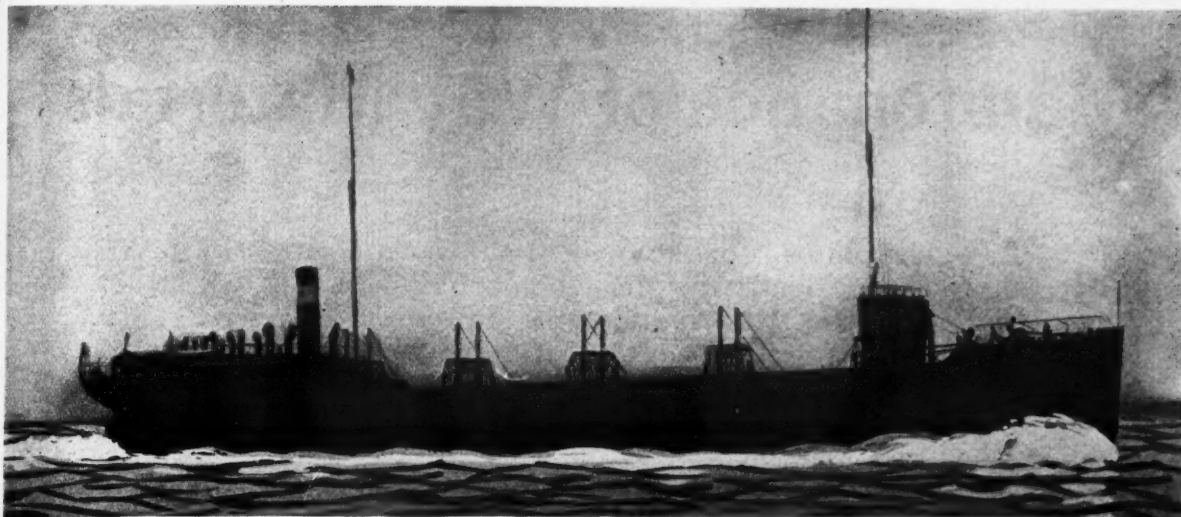
Plants:

Indianapolis

Minneapolis

Seattle

Mobile



Where Space is at a Premium and Cleanliness and Comfort Essential

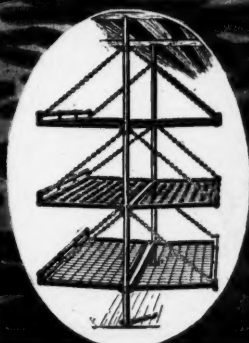
In the ships that carry the "black diamonds" to Uncle Sam's gray squadrons, there's no room for fancy appointments in sleeping quarters—space is too valuable. But the "jackies" are taken care of in the first class fashion characteristic of all American naval vessels. The sleeping quarters are models of cleanliness and compact comfort, because

Uncle Sam Uses Romelink All-Metal Bunks

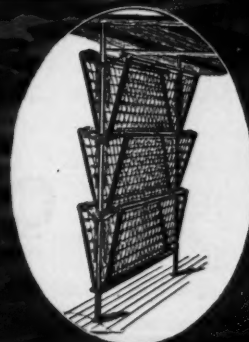
on his naval colliers, Engineer Dredges, Light Ships, Submarines, Submarine Chasers and Torpedo Boat Destroyers. The same consideration that led to their adoption by the U. S. Government should carry weight with you in selecting bunk equipment for construction camps and work cars.

Romelink Bunks are all steel, hand riveted, fireproof and hence practically unbreakable. The patent spring is sagless—this makes a comfortable and durable bed. There are no corners or crevices—dirt and vermin can't collect; keeping these bunks clean is an easy matter.

So if you are interested in comfortable, durable and sanitary bunk equipment—and we know you are—drop us a line and let us give you the reasons why Romelink Bunks are ultimately the most economical. A postal will do.



**Southern Rome
Company**
617-633 West Pratt St.
Baltimore, Md.



Maintenance of Way Materials

Mr. Roadmaster:—

The railroads of the country in their cooperative efforts to give to the country the greatest possible amount of freight service have effected extraordinary improvements in car movement. The largest volume of traffic in the history of the United States is being moved with a despatch and a smoothness which reflects great credit upon American railway management—management, which in spite of financial and other handicaps, has maintained roadbed and equipment in such superb shape as to enable it to meet well the unprecedented demands upon it.

You have done your part to make this enviable record, because you have used well the materials placed at your disposal. You can maintain that record by the judicious selection and wise use of the best materials for track construction and maintenance.

The best is none too good for your road.

When you purchase remember that the Carnegie Steel Company has had long years of experience in its line and is ready to give you the benefit of that experience in high grade products carefully rolled and well designed to make perfect track.

Among these products are:—

RAILS
STEEL TIES

Standard and Light. Every up-to-date type.

SPLICE BARS

Heavy sections for permanent track construction.
Lighter sections for use in mines and portable track.

DUQUESNE BARS

Plain or Reinforced Bars, untreated or treated, in a completely equipped Heat Treating Plant.

BRADDOCK JOINTS

One of the most efficient types of improved joints, especially designed for service under heavy traffic.

An insulated Rail Joint which has satisfied the most severe critics and which has been adopted as standard by many leading railroads.

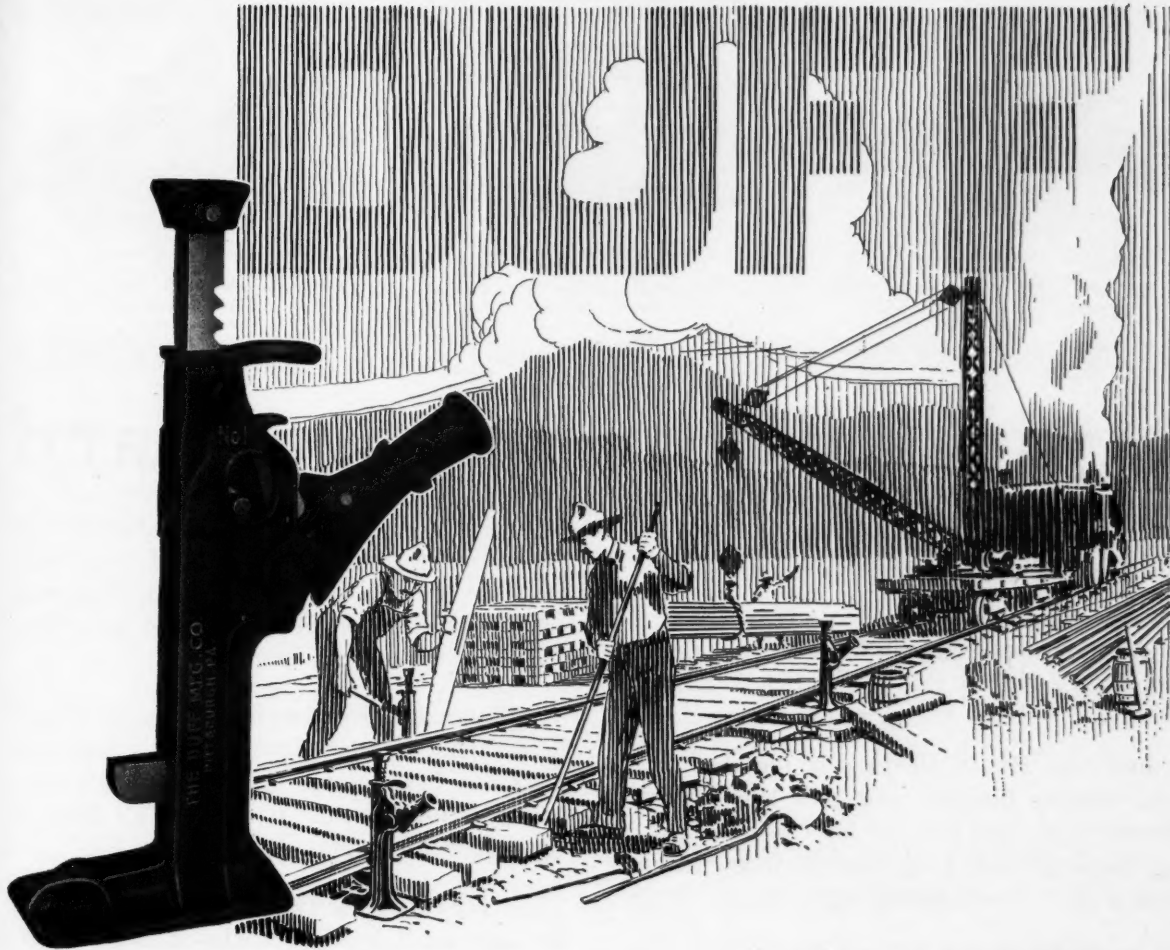
The mark of
quality



It protects the
user

Carnegie Steel Company

General Offices—Pittsburgh, Pa.



What is a good track jack—?

A good track jack must help increase track efficiency and reduce maintenance cost—to accomplish this it must work with utmost speed, it must lift quickly, easily and safely, and trip instantly upon the approach of trains.

Also it must be light in weight to be conveniently handled by one man—yet powerful enough to be used in yards for heavy work around switches and frogs.

DUFF TRACK JACKS— GENUINE BARRETT

are just such jacks. For constructing, surfacing, ballasting and repairing railroad track they are the recognized standard tools used by practically all railroads.

Standing squarely behind the performance of every jack is the name and reputation of the world's largest jack manufacturers—makers of railroad jacks since 1883—and the most accomplished jack engineers in America.

They conform strictly to the requirements of the Roadmasters Association of America, are quick acting, positive and durable. Manufactured in a large number of sizes and types they are adapted to every track condition. Made in both single and double acting types.

A special bulletin describing in detail Duff Track Jacks will be sent upon request. Write for it today.

THE DUFF MFG. CO. (Established 1883)

PITTSBURGH, PA.

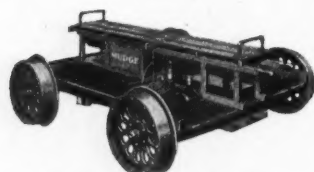
New York

Chicago

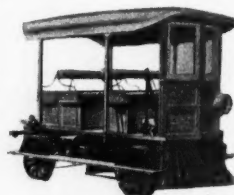
Atlanta

St. Paul

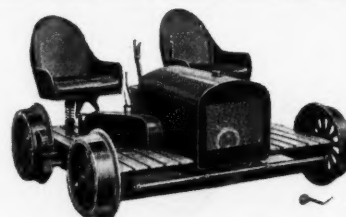
San Francisco



Motor Car (4 Hyatt Bearings)
Mudge & Co.
Chicago, Ill.



Motor Inspection Car
(4 Hyatt Bearings)
The Buda Co.
Harvey, Ill.



Motor Car (4 Hyatt Bearings)
Fairmont Gas Engine and
Ry. Motor Car Co.
Fairmont, Minn.

Rapidly Becoming Standard

The Hyatt Bearing is rapidly becoming the standard bearing in all industries.

In the railway service car field particularly, its popularity is increasing by leaps and bounds.

Why?

Because the Hyatt Bearing is founded on sound healthy bearing principles, because to look at it even, one gets the impression of the rugged strength and long-lived efficiency, with which it is so closely identified.

And finally because it delivers the goods.

The great reduction in power and oil and labor made possible by Hyatt Bearings, its ability to withstand the knocks and shocks sustained by section cars, and the ease with which the Hyatt Equipped cars operate at all times, has caused the leading railroads of the country to demand Hyatt Equipped service cars.

So the leading service car manufacturers have quickly fallen in line and now are loud in their praise of the Hyatt Bearings on their cars.

The following opinions of Hyatt Bearings expressed by some of the foremost manufacturers of service cars are of great value to every road master and maintenance engineer.

The Fairmont Gas Engine and Motor Car Co. are in a position to supply Hyatt Roller Bearings on all their cars. "Another step towards greater efficiency," is the way they say it.

The Kalamazoo Railway Supply Co. has "such faith in the Hyatt Roller Bearing," that they have "no hesitancy in recommending it anywhere, knowing that it will do all that is claimed for it.

"The Hyatt Roller Bearing is without doubt the last word in high efficiency and ruggedness," says the Buda Company. "We have no hesitancy in recommending it."

Mudge & Company say that "the slight extra cost of the Hyatt Bearing is fully justified by its marked superiority over any other."

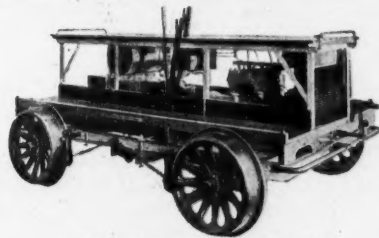
An extract from the letter of Adams Motor & Company. "We recommend unqualifiedly, the Hyatt equipped service car to any railroad interested in minimum gas consumption and maximum satisfaction."

The Railway Motor Car Company of America announce that they are ready to furnish motor cars equipped with Hyatt Bearings. In their opinion "Hyatt Flexible Roller Bearings have no equal when it comes to low up-keep cost and durability."

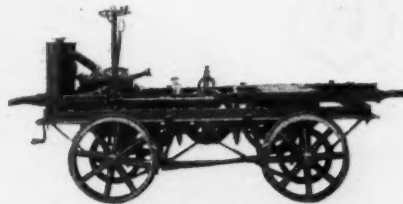
HYATT BEARINGS



Sheffield Motor Car (2 Hyatt Bearings)
Fairbanks-Morse Co.
Chicago, Ill.



Motor Car (9 Hyatt Bearings)
Kalamazoo Ry. Supply Co.
Kalamazoo, Mich.



Motor Inspection Car (4 Hyatt Bearings)
Railway Motor Car Co. of America
Chicago, Ill.

"We have been selling Hyatt Equipped Motor Cars for a long time and know that the bearings have given very good service. Our judgment would lead us to recommend them as the best for hand and push cars," say the Fairbanks-Morse Company.

From the foregoing letters, you can easily see just what a high position Hyatt Roller Bear-

ings hold in the estimation of these manufacturers.

These letters explain why Hyatt Bearings are rapidly becoming the standard bearings for service cars on the principal railroads throughout the country.

Make sure that the next cars you order are equipped with Hyatt Bearings. And remember that manufacturers furnish Hyatt equipped boxes for old cars. See list below.

A List of the Foremost Railroads in the country using Hyatt Equipped service cars.

New York Central Lines. Bessemer and Lake Erie R. R. Delray Connecting R. R. P. C. C. and St. Louis R. R. C. C. C. and St. Louis R. R. Union Traction Co. of Indiana. Pennsylvania Lines. Indianapolis Union Ry. New York, New Haven & Hartford R. R. Akron & Barberton Belt R. R. Central R. R. of Pennsylvania. Boston and Maine R. R. Chicago, South Bend & N. Indiana R. R. Pere Mar-

quette R. R. Chicago, Milwaukee & St. Paul R. R. Southern Pacific R. R. Montour R. R. Lehigh Valley R. R. New Mexico Central R. R. Missouri Pacific R. R. Illinois Central R. R. Savannah & Northwestern R. R. Galveston, Harrisburg & San Antonio R. R. Arizona and New Mexico Ry. Buffalo, Rochester & Pittsburgh R. R., and 43 other railroads—including the largest roads in South America.

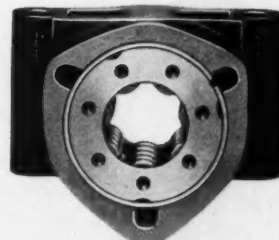
Hyatt Roller Bearing Co., Newark, New Jersey

LIST OF MANUFACTURERS AND BOXES THEY CAN FURNISH YOU



Replacement box equipped with Hyatt Roller Bearing ready for installation on motor car.

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Railway Maintenance Engineer

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There has never been a time when there has been as great a demand for devices and equipment which will

Contest on Labor Saving Devices

economize in the use of labor as at the present. This condition has existed for two years, but has become increasingly severe from month to month. The acuteness of this situation in the maintenance of way field has led to the development of many interesting devices recently, the larger number of which are relatively simple, but all of which are valuable, particularly at present. In some instances these devices have been patented and are being brought to the attention of railway men by the supply companies. However, in most instances they have not been patented, and their use has been confined to the local territories in which they have been originated. We desire to call this latter class of devices to the attention of railway men throughout the country by describing them in our columns. To stimulate interest in this subject we wish, therefore, to announce a contest on Maintenance Kinks, for which we solicit descriptions of methods or devices which are new or not generally known. Descriptions of devices will be limited to those the universal use of which is not restricted by patents. We desire to publish descriptions of kinks applicable to track, bridge, water service and other branches of the maintenance of way department. All contributions should be sent to the editor of the *Railway Maintenance Engineer*, 608 South Dearborn street, Chicago, and must be received before November 10. Prizes of \$25 and \$15 will be awarded for the first and second best contributions, respectively, while all

others accepted and published will be paid for at our regular space rates. The prizes will be awarded for descriptions of those devices which, in the opinion of the judges, are of the greatest practical value and the widest application for maintenance work.

While the present acute problems of the bridge and building department are common to all branches of the

The Bridge and Building Convention

maintenance of way department, to a certain extent they differ in character from those encountered in allied branches of railway service and require individual study. The material problem is confined primarily to steel products. The delay in securing deliveries of materials of this character has led to the use of other materials, such as concrete and timber, in many instances, so that it has been possible to proceed with much of the work, although along different lines.

The labor problem has been that common to other branches of maintenance work in that it has been impossible to retain adequate forces in competition with other industries which have paid much higher wages. This condition has been particularly aggravated recently in the vicinity of the cantonments. In recruiting carpenters and other skilled artisans, the bridge and building department is confronted with a different problem than the track department, for experienced men are more essential. Consequently when a force is disrupted, as many forces have been recently, the process of reorganization is much slower. It is problems such as this that the American Railway Bridge and Building Association

will discuss at its convention in Chicago on October 16-18. The intensity of the problems of this department and the suddenness with which they have arisen make the exchange of information and the concentrated study of these questions more than usually necessary. For this reason the attendance should exceed that of normal years. With the central location of Chicago and the practical character of the program which will be presented, those in charge of the maintenance of way departments can well afford to grant permission for their men in the bridge and building department to attend this meeting.

THE CAR SUPPLY AND COMPANY MATERIAL

THERE has never been as great a demand for cars as during the last year. Only a few months ago the roads were confronted with the largest shortage in their history. To enable them to meet the unprecedented demands for transportation, they have called upon their patrons for co-operation and have received very encouraging support from the shippers in loading cars to capacity, in releasing them promptly when unloaded and in conserving the supply in other ways. The support which the shippers have rendered makes it all the more incumbent upon the railway employees to do as much and more. For this reason one road which has undertaken an active campaign along these lines was surprised to find that the least responsive class of shippers comprised those of its own employees who were interested in the handling of company materials, and that the relative improvement in the handling of cars was less here than with revenue traffic. As a considerable proportion of the materials handled in company service is those used in the maintenance of way department this problem is of special importance to men in this branch of the service at present.

Railway employees have long been accustomed to consider that transportation costs them nothing. Until recently this was fostered to a large extent by the practice of including no charge for transportation in estimates for work to be done, although as a matter of fact it costs just as much to haul a ton of freight for company use as for a patron. However, the question of car supply is even more important at present than that of the cost of transportation. General officers can do much to remove abuses in the handling of cars in the maintenance of way department, but the division engineers and supervisors on the ground can do more than this to conserve the interests of their railroads by seeing that shipments of company material are so loaded as to require the least number of cars the shortest practicable time.

In most instances the maintenance of way department is a consignee rather than a consignor of freight and the greatest opportunity for conserving cars lies in their prompt unloading upon receipt. It has been customary to compare the estimated cost of releasing cars promptly with that of delaying and unloading a large number at one time to secure economies in handling the materials received, but estimates of this character, which were correct a couple of years ago, have been rendered entirely obsolete by the changed conditions at present. The primary problem is not now one of immediate economy, but rather that of securing the maximum use of every possible car to meet the transportation needs of the country. Surely employees of the railroads should do no less than the shippers to co-operate in a campaign of this character; rather, they should set the pace. The problem of car supply is a real one for the roads at present, and the employees of the maintenance of way department can do much to assist the roads in its solution.

THE PERMANENT EMPLOYMENT OF LABOR

ALTHOUGH the St. Louis-San Francisco has made a number of radical departures from current maintenance practices, none is more important than the establishment of a minimum force. As described on another page, this road has had a plan in effect for the past two years whereby the section forces on main lines are not reduced, under any conditions, below four men and a foreman, and those on branch lines below three men and a foreman, when this number of men is available. In other words, the practices of laying men off late in the month to bring expenses within an arbitrary maximum and of reducing forces to a low level in the winter have been discontinued.

The section gang is the unit of the track maintenance organization and any plan which will obtain and hold experienced men for these gangs is valuable. No one condition has tended to drive men from track work into other industries more than irregularity of employment. The custom of laying men off without notice during the working season, even though frequently only for a few days to make a paper showing, is particularly to be condemned, for while it accomplishes the immediate purpose, it is expensive because of the disorganization of the forces and the loss of experienced men which necessarily follows. The same condition results from a reduction in the winter forces.

By following these practices the roads have failed to appreciate that every man trained even for the most simple work constitutes an investment on the part of the company. It costs money to recruit and place a trackman at work; it costs more to train him to become proficient in his duties. Many industries have long since realized this fact and have given careful attention to means for lengthening the average period of service of their employees. When a road lays off a man for a few days or for the winter months, there is a strong chance that he will not come back, and if he does not, the time and money spent in training him is lost.

Equally or more serious than this is the fact that the better class of employees dislikes temporary work. Good men naturally desire to locate with industries where security of employment is assured. As a result they are soon lost to the roads and this weeding-out process results in the roads being able to secure only the less efficient men with all that this implies.

The comment is frequently heard among trackmen that the losses from these causes are so great as to justify a road in keeping its section men in service throughout the winter, even to the extent of paying them for three months' unproductive time. However, in most parts of the country, it is not necessary that the time spent during the winter should be lost. It is more convenient to do track work in the summer; for this reason it has become the habit to do practically all of it during this season and as a result many men have come to believe that it must be done then. This is not the case. If a road once authorizes the retention of a reasonable number of its men during the winter and a supervisor is confronted with the necessity of keeping these men employed, he will find that he can do a surprisingly large amount of constructive work in the winter and reduce the summer peak load to that extent. As an instance of work of this character, one need only refer to the Lehigh Valley practice of laying all of its rail during this season. Furthermore, it will be found that in spite of the time lost because of adverse weather conditions, the unit costs will exceed those of summer work little, if any, because of the greater efficiency of the more experienced workers. More than this, the

retention of these experienced men in the service will yield returns all through the following year.

The objection will be raised that the men will stay with the road during the winter when work elsewhere is scarce, but will leave in the spring. To a certain extent this is true, particularly in times such as the present, for no plan for the improvement of working conditions can be expected to overcome entirely the disparity between a wage of \$2.25 on the track and \$3 to \$3.50 or more elsewhere. However, the experience of those roads which have tried this plan in normal seasons as well as this year have shown that it has exerted an important influence in holding men in service. This is particularly true in the latter part of the summer when men who would otherwise leave for the harvest fields and other temporary employment, remain with the roads, knowing that they will have work during the winter.

Until the roads universally abandon the present hand-to-mouth methods of hiring and discharging their track laborers and adopt some more uniform policy whereby they can offer a reasonable certainty of tenure of employment to their men, they can expect men to enter their service only as a last resort. The attention which is now being given to the entire labor subject will undoubtedly lead other roads to adopt plans similar to those in effect on the Frisco and the Long Island.

THE SUPERVISORS' RESPONSIBILITY

MANY supervisors are inclined to place the blame for the present labor conditions on their higher officers and fail to realize that they must also share the responsibility for the solution of this problem. It is true that wage rates and other matters involving questions of policy must be determined by the managements, but the influence of the supervisors, if exerted properly, is an important factor in the determinations of the decisions on these questions. Moreover, the labor problem includes far more than these broader questions passed on by the managements. While it is difficult and perhaps impossible to overcome a wide discrepancy in wage rates, many factors which exert an important influence in the holding or losing of men are controlled directly by the supervisors and foremen, who come directly in contact with the laborers. One has only to compare the forces on adjoining territories to illustrate this. At the present time when the amount of work which a supervisor can accomplish is limited directly by the number of men he has rather than by the funds placed at his disposal, it is vital that he study ways of retaining as large a force as possible. One of the most effective methods of holding men is the provision of conveniences which improve their living conditions. Important as the wage rate is to the class of men employed as track laborers, it is not the only consideration, for it has been proven time and again that men will remain in service on roads at lower wages where comfortable camps are provided, where good food is served and where other little and commonly inexpensive comforts are provided. In times such as these, when the competition for men is unusually acute and where the advantage is all in the hands of the men, attention to the welfare of the employees is more than usually productive of results. The supervisor who realizes this and who gives this subject personal attention will secure greater results than are possible in any other way. Important as the technical knowledge of his work is to its successful prosecution, even this is secondary at the present time to a knowledge of men and of methods of securing and holding them.

LETTERS TO THE EDITOR

A FOREMAN'S ABILITY TO HOLD MEN

TERRELL, TEX.

TO THE EDITOR:

In order to maintain a section of roadway properly and to improve the condition of his track steadily, a foreman must first organize his gang of laborers, and then proceed systematically with his work planned ahead as far as possible. The fact that extra jobs or a shortage of men occasionally interferes with this program is no valid reason why the plan cannot be followed.

Keeping his hand or motor car equipment and his track tools always in good repair will assist a foreman to retain a skilled force of trackmen, for there is always a certain class of men who follow section work and who prefer it to other higher paid labor simply because this work offers more steady employment. If the force is properly handled, these men will feel at home and do good work for the company if the foreman treats them properly.

It sometimes happens that a foreman is given charge of a rundown section. That is the time for him to show if he is possessed of untiring energy and sound judgment. If he gets impatient and starts working all over the section without finishing any of it up in proper shape, he is only making more work and trouble for himself.

A track foreman must be a student and a teacher. He should be able to teach his men by word and example; and he must study his work. He should also study human nature, and last, but not least, he should read railway literature and books treating on track work and kindred subjects.

THEO. RADEMACHER,
Section Laborer, Texas Midland.

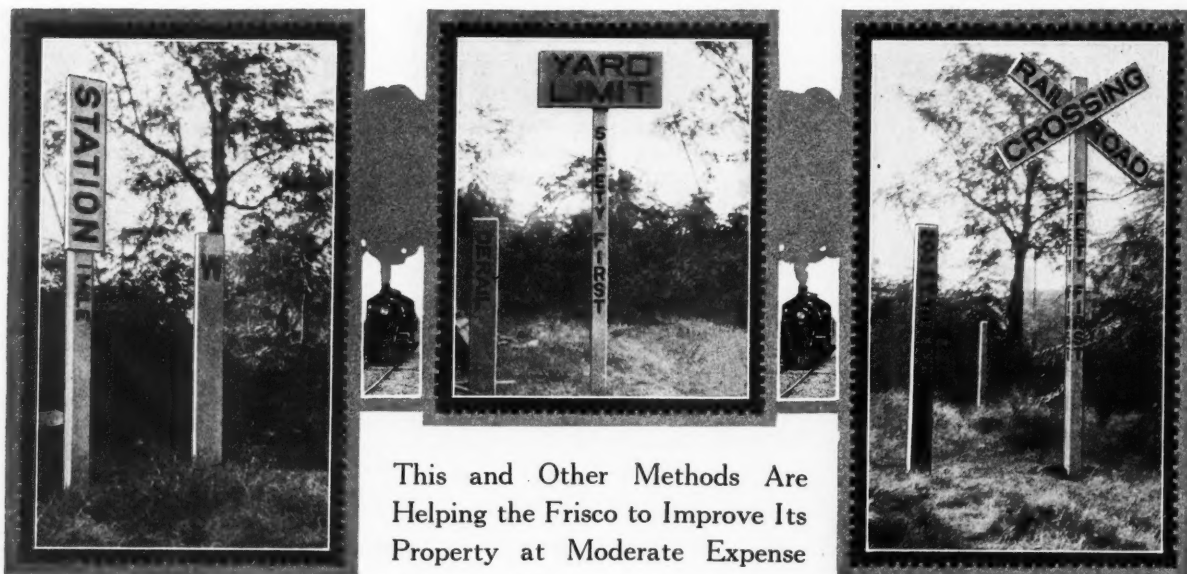
NEW BOOKS

Railroad Construction, Theory and Practice. By Walter Loring Webb. 4 in. by 7 in. 841 pages. Illustrated. Bound in leather. Published by John Wiley & Sons, Inc., 432 Fourth Ave., New York City. Price \$4.

This is the sixth edition, revised and enlarged of the well-known treatise on railroad construction. The author explains in the preface that recent progress in railway engineering has made extensive rewriting necessary. The book is intended both as a text for the use of students and as a handbook for the engineer in the field and office. The first 100 pages are devoted to the mathematics and field and office methods of railway location, curves, grades, etc. Earthwork occupies 84 pages; trestles, tunnels and minor structures cover an equivalent space. About 100 pages are devoted to the various elements of track construction and a smaller space to buildings, yards and terminals and signaling. The economics of railway location is discussed in detail as in the earlier additions. Nearly 200 pages are devoted to curve and earthwork tables.

THE SECOND LIBERTY LOAN—At the request of the Treasury Department, the railroads of the United States will co-operate in the publicity campaign that is being planned for the second Liberty Loan. Colored posters advertising the new issue of Liberty Bonds will be placed in the waiting room of every railroad station in the country. Thus the Treasury Department will be able to reach the millions of persons who use the railroads with its announcement of the Loan.

PERMANENT FORCES FOR MAINTENANCE WORK



This and Other Methods Are Helping the Frisco to Improve Its Property at Moderate Expense

New Concrete Roadway Signs

FEW roads have made more marked improvement in the condition of their physical properties during the last four years than the St. Louis-San Francisco. Prior to the appointment of the receivers in 1913, expenditures for maintenance had been severely curtailed and as a result the track and structures had deteriorated seriously. However, as soon as the Frisco went into the hands of receivers, the management undertook a comprehensive plan of rehabilitation which has been continued after the road passed out of the control of the court. As a result the property is to-day in a greatly improved condition. This has been made possible by the more liberal expenditure of money, aided in large measure by the adoption of more scientific methods in the use of men and materials.

There has been an increasing realization among railway men that many of the long-established practices in the handling of men have become obsolete under present-day conditions, and the management of the Frisco has deviated from these practices in a number of ways with excellent results. A number of interesting methods have also been developed for the economical use of materials. Because of the advantages which they have shown, these and other practices followed on this road are described below in some detail.

GENERAL CONDITIONS ON THE PROPERTY

The St. Louis-San Francisco extends from St. Louis southwest into Kansas, Oklahoma and Texas and south to Memphis and from Kansas City southeast to Birmingham, Ala. It includes 5,200 miles of lines with 43 miles of second track and 1,547 miles of side tracks. Approximately 2,400 miles, or 45 per cent, of the lines are classified as main lines and 2,800 miles as branch lines. The traffic is highly diversified and aggregates about 600,000 ton miles of freight and 100,000 passenger miles per mile of line annually. Ten-wheel and consolidation locomotives with weights on drivers of 62 and 87 tons, respectively, are used largely in road service on the main lines.

After several years of restricted expenditures, during

which but little new rail, ballast or similar materials were used, the road passed into the hands of receivers on May 27, 1913, and remained under the supervision of the United States Court until November 1, 1916, when the receivers were discharged. Prior to the receivership much deferred maintenance had been allowed to accumulate, and when the receivers were appointed the road was in poor condition. The management under the receivership, which was the same as that now in control of the property, at once undertook a general campaign of improvement, not only to return the road to its proper physical condition, but also to strengthen the track and structures materially to permit the operation of heavier engines. While more money has been available since the inauguration of the receivership, the restrictions on funds have still been such as to require rigid economy in their expenditure to permit the desired results to be secured. This condition, which confronted a management willing to try new methods, has led to the development of a number of interesting practices.

As an indication of the improvement which has been effected during the four years which have elapsed since the appointment of the receiver, over 875 miles of new 90-lb. rail has been laid in main lines and this amount of track has been thoroughly reballasted. The rail released from these lines has been employed in the strengthening of branch lines, many of which were originally built as light logging lines and to low standards. All tracks have been generally re-tied, while large quantities of ballast have also been inserted at points other than where rail was relaid. An extensive campaign of bridge reconstruction has also been carried on, the bridges on all the main lines except between Sherman, Texas, and Tulsa, Okla., having been rebuilt to permit the operation of heavy-power. While these improvements have been of great value in permitting a reduction of transportation expenses through the use of larger engines, there has been an immediate saving through the increased tonnage which the same engines can pull on these lines. As an instance, it has been found possible to in-

crease the tonnage rating between Kansas City and Fort Scott, Kan., from 1,900 to 2,100 tons for the same engines, while at the same time the number of derailments has been reduced 30 per cent.

THE MAINTENANCE OF WAY ORGANIZATION

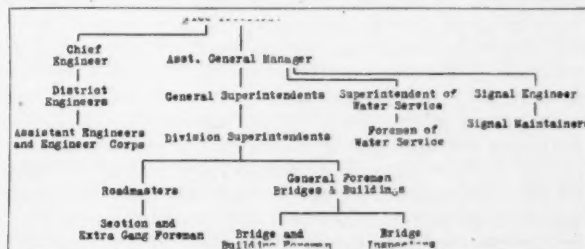
In common with the practice on a number of the larger western roads, maintenance of way work on the Frisco is handled by the operating department, largely independent of the engineering department except with reference to the preparation of standards. The vice-president and general manager is in direct charge of maintenance work and gives it a large amount of personal attention. The system is divided into two districts, each in charge of a general superintendent, who is in charge of maintenance on his territory. Division superintendents report directly to the general superintendents on maintenance as well as operating matters. Track and bridge maintenance are handled by roadmasters and supervisors of bridges and buildings, respectively, who report directly to the division superintendents. Water service over the system is in charge of a special man on the staff of the assistant general manager, who also has charge of all plumbing, steam heating and other piping work.

Standard plans for maintenance of way work are prepared by the engineering department under the direction of the chief engineer and subject to the approval of the general manager. The engineering department, through four district engineers and their corps, also handles all distinctly engineering work, and all work done by contract, although the operating department has sole charge of the men and the actual administration of work done by company forces.

The signal maintainers report to the signal engineer, who in turn reports to the assistant general manager on

bills, they can vary their forces as the conditions demand, but if necessary to exceed the allowances, they are required to secure special authority from the assistant general manager.

As far as possible all construction work along existing lines is done by company forces working under the maintenance of way organization. This includes small jobs of grading, concrete work, the drilling of wells, etc. Concrete mixing equipment involving an expenditure of over \$35,000 has been purchased recently. Eleven steam



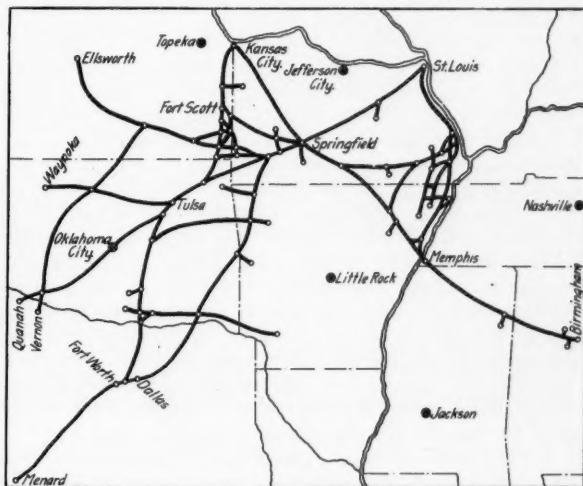
ORGANIZATION DIAGRAM

shovels are employed in ballast pits and in improvement work. The road has also bought a number of slips which are used for ditching by local teams hired under the direction of the section foremen. By taking advantage of the dull seasons for the farmers, it has been found possible to get a large amount of ditching done very cheaply. The road drills all its wells, maintaining crews at this work continually. As an illustration of the saving effected, two wells were drilled at Springfield shops recently at a total cost of \$1.15 per foot as compared with \$3 per foot bid by contractors and they were placed in service within 90 days after their construction was authorized.

PERMANENT FORCES EMPLOYED

One of the greatest improvements made in the conduct of maintenance work has been the establishment of minimum section forces, over the system below which the size of the gangs is not reduced at any season when the men can be secured. This minimum has been established at four men in addition to a foreman on main lines and three men and a foreman on branch lines. Wherever possible this number of men is employed at all times and extra men are added as the work demands. Previous to the adoption of this system it was the practice to reduce forces during the winter to as low as a foreman and one or two men and sometimes late in the month to lay off all men to keep within the allowance. The adoption of the minimum force system about three years ago has insured permanent employment to this number of men and has assisted the road in holding many experienced men and in keeping its gangs more nearly full. Last year a shortage of section laborers was encountered at only a few points and while conditions have been somewhat more acute this year, the surety of steady work through the winter has tended to hold the men in the gangs.

Another interesting departure has been the development of two permanent rail laying gangs, one on each general superintendent's district. These gangs are employed throughout the year, working on the lines in Missouri and Kansas during the summer, and gradually moving south into Alabama, Mississippi and Texas during the winter. These rail gangs comprise from 90 to 125 men each. While many of the men drop out singly from time to time, the organization is held intact and prob-



MAP OF THE FRISCO LINES

all new work and on maintenance. All bond wire and lamp maintenance has been turned over to the track forces and the maintainers' mileage has recently been doubled, being now 20 miles. These measures have made it possible to reduce the number of maintainers 30 per cent.

Each general superintendent is given a monthly allowance for maintenance of way expenditures which he divides among his division superintendents. As long as these officers stay within the figures allotted them, which include labor, material and all other department

ably 30 men have been with each of the gangs for two years or more. With this large nucleus of experienced men the efficiency of the gang is considerably above that of other temporary gangs. The foremen are now paid \$125 with the prospects of a still higher rate as they increase the performance of their gangs.

As far as possible all rail is laid by these permanent gangs, although other gangs are put on if the work requires it. The steel gangs, as well as the bridge gangs, pile driver crews, etc., are provided with portable telephone sets, by means of which they can communicate with the dispatcher or other officers at any time. A total of 58 portable sets with about 20 extra sets are kept available in the office of the superintendent of telegraph at Springfield for use as required.

Surfacing gangs follow closely behind the steel gangs, renewing ties and raising the track out of face on new ballast. These gangs endeavor to keep within two days of the steel gangs to give the new rail proper support before it becomes surface bent. When working in chatt ballast five surfacing gangs of 60 men each are employed while in stone six gangs of 70 men are worked. One of these gangs lifts the track behind the steel gang, another unloads the material and the others put it under the track and surface it. These gangs are also employed throughout the year, following the rail gangs from place to place.

Bridge gangs have also been reorganized in an endeavor to retain experienced men. Where formerly all men were paid a flat rate of 27 cents per hour, two or three men in each gang are now paid 35 cents per hour and the rest are paid the prevailing labor rate of 20 to 25 cents.

Until recently the feeding of the men in floating gangs was handled by the foreman. However, this was found to lead to abuses and it has been turned over to the con-

ing and office compartment is provided for the foreman, while one car contains the cooking and dining facilities. These cars are being provided first for the bridge gangs, 60 such camps being required. As soon as these gangs are supplied, similar camps will be provided for the track floating gangs. The old cars now in this service are being scrapped as fast as released.

Another important aid to section work has been the rearrangement of section limits and the installation of



STANDARD ROADBED AND DITCHING

motor cars. The road had previously installed the engines on the hand cars for those foremen, who bought the engines and had maintained them and furnished the gasoline. However, this practice had been discontinued, and, starting a year ago with the installment of motor cars on the St. Louis-Springfield line, the cars are now being placed on all sections. Within two years it is expected that all the 450 sections will be provided with motor cars, one division being equipped completely at a time. These cars will all be of one type to simplify repairs. To preserve this uniformity, the road has overhauled the engines purchased previously by the foremen so they can sell them to advantage and get off the road all other than the one type of car adopted as standard. An inspector has been employed to install these cars as they are received, to train the foremen in their use, and to adjust and make minor repairs to them in service. By this measure it is expected that the intervals between overhauling in the shops will be extended greatly.

As these cars have been installed, the section limits have been extended, the amount varying with local conditions, but the new mileage averaging double the old. In this way 28 sections were eliminated on the Eastern division alone. This has enabled the road to raise the pay of the section foremen to \$75 per month without increasing the total outlay for this account. All section foremen are expected to be working foremen, setting the pace for their men and raising the efficiency of the gang to that set by themselves.

Numerous small bridge gangs have also been combined into larger ones and provided with motor cars, while the wages of the foremen have been increased to \$110. This has enabled the road to retain the best men and pay them more while reducing the total payroll for foremen. It is also planned to provide motor cars for all concrete, water service and track floating gangs.

In selecting the type of motor car to be used, a careful analysis was made of the accidents following their use. As a result of which it was found that a large number resulted from tools falling in front of the cars and derailing them, throwing the men in front of the cars. To eliminate this danger, a metal frame with a wire netting has been provided at each end of the car with a connecting rod at the top lengthwise in the center of the car. This rod and frame give the men a support



NEW RAIL AND BALLAST SOUTH OF SPRINGFIELD, MO.

tractor who provides the labor under an arrangement whereby he is not allowed to charge the men an employment fee.

EQUIPMENT TO HOLD LABOR

As a part of the campaign to give increased attention to the welfare of the men, a large number of practically new furniture cars which were found to be unsuited for their original use are now being converted into camp cars for the use of bridge gangs. These cars are being rebuilt completely by car apprentices at the Springfield, Mo., shops. New floors are added with an air space above the old floor, and the cars are sealed entirely on the inside. A window is provided for each bunk and steel bunks equipped with springs are being installed. Individual lockers are provided for the men. Running water and a sanitary toilet are placed in each car, while each camp is equipped with a shower bath. A separate sleep-

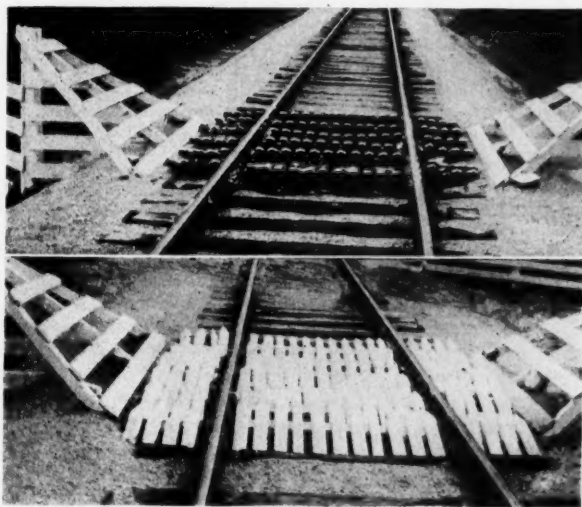
to hang onto while the netting prevents any object on the car from falling in front of the wheels.

TRACK STANDARDS

The present standard weight of rail for main lines is 90-lb. section with Continuous joints. For the last four years approximately 300 track miles have been laid each year and this has all been fully ballasted afterward. Before undertaking the work on the main lines, all curves were re-run with a transit, easements determined and center stakes set. All ends of curves and points of compound curves are indicated with curve boards.

Previous to the renewal of rail it has been the general practice to widen cuts and embankments. Many rock cuts along streams have been widened and cast iron drains inserted to conduct the water away rapidly and prevent slides from developing. A large number of French drains have also been built and have improved roadbed conditions greatly. In general wide ditches and cross drains have been found to eliminate the necessity for longitudinal tile drains.

At several points along the Meremac river a short distance west of St. Louis, severe washouts were encountered two years ago and the main line was out of service for 4 days. To prevent similar trouble at this point, stone protection has been placed on the lower slope, extending 1½ ft. above the track to prevent washing. To hold the track in place anchors were driven 10 ft. into the bank with the tops fastened to the base of the rail. Until the last two or three years, rip rap was purchased for protection work of this character, but this has been



WOODEN PICKET CATTLE GUARD

discontinued and all the stone required is now secured from the widening of rock cuts, thus securing two improvements for the price of one.

As rail is released when relaying main lines, it is sorted and the best is sent directly to important branch lines. Rail which is battered or that which has rolled out badly is rerolled, about 5,000 tons of 85-lb. rail being reduced in this way to a 76-lb. section this year. All joints, switch plates and other fastenings on lines showing evidences of brine corrosion are coated annually with crude oil.

All switches now being installed are of a special design called the Levy safety switch, the special features of their construction being a lug which holds the switch

point in place at the end and a filler block supported at the center giving added strength. Over 500 or these switches are already in use on the Frisco.

In connection with other track work, tie renewals have been very heavy during the last few years to take up the deferred maintenance. Approximately half of the ties used are treated, these being placed in the lines where timber untreated has the shortest life and on those on which the heaviest engines are operated. Tie plates are used on all treated ties, on all ties on bridges and on curves of 3 deg. and over, and on lines carrying heavy power.

The practice of storing ties along the right of way has been discontinued and they are now held in the treating yard or as piled by the contractors until needed. They are ordered by the roadmaster monthly as needed and are unloaded from the main tracks at the points required. In this way the appearance of the right of way is improved, losses by theft are reduced and the ties are used only where needed. Losses by early decay during storage are also eliminated, the experience before the adoption of this practice being that a considerable number of ties were covered with fungus before they were placed in the track.

As far as possible, no time is set aside for the general renewal of ties, but they are inserted all through the year. This permits more nearly the full life of the tie to be secured and results in more uniform track conditions. It also enables the section gangs to distribute their work to better advantage.

From 30,000 to 40,000 cars of ballast have been put under the tracks annually during the last four years. This has consisted of chatts, gravel, rock, sand and slag. During the fiscal year ending June 30, 1916, 22,012 cars of chatts, 7,152 cars of gravel, 2,994 cars of slag, 2,472 cars of sand and 1,511 cars of rock were unloaded. This is used to raise the tracks out of face where new rail is laid, and in spotting work elsewhere. The continuation of this work for the last four years has resulted in the main line now being quite generally ballasted.

It has been found that the mixing of chatts and gravel makes a better ballast than either alone, the chatts being angular but light weight, while the gravel used is heavy but round. Because of this it is the practice in patching work to put chatts in where gravel already exists and gravel on old chatts. On new work chatts are placed in the center of the track and boxed in with gravel on the shoulders, except where there is a heavy side wash, where crushed stone is inserted in place of the gravel.

In widening the banks and rebalasting main tracks, the local division officers have had much difficulty in dividing the charges between the operating and additions and betterments accounts. To avoid this confusion each division superintendent is now given authority at the beginning of each season to unload a certain number of cars of ballast on his district, and he is required to regulate his expenditures in this way. These materials are unloaded under the superintendent's direction and the charges are distributed automatically in accordance with the original estimate accompanying the authority.

BRIDGE WORK

As far as possible all concrete work is done by company forces under the direction of a general foreman on the staff of the assistant general manager. This man has charge of the distribution of these forces, the maintenance and distribution of equipment, the compilation of cost records of the work, etc. The gangs are generally assigned to the different divisions where they work under the supervision of the local officers, although the general

foreman may transfer them from one division to another.

Larger locomotives have been placed in service during the last few years and still larger engines with a tractive power of 71,480 lb. and a weight on 5 pairs of drivers of 296,000 lb. will soon be purchased. This is requiring a large amount of bridge strengthening and renewal work. In renewing bridges, permanent structures are being built at those points where the estimated cost does not exceed $2\frac{1}{2}$ times that of the original structure, and at such other points as special conditions warrant. By following this program practically all timber bridges should be removed within seven years. Four or five creosoted deck structures have been built but reinforced concrete slab and pile trestle construction is now being employed exclusively, these units being cast at a central yard at Amory, Miss. Concrete pipe is used for small culverts under main and branch lines.

To handle this work the company expended over \$35,000 in new concrete equipment last year and over \$15,000 this year. The equipment now in service includes 15 power operated concrete mixers, 15 hand mixers and the necessary auxiliary equipment. It is now planned to discontinue the use of the hand-operated equipment and to secure the desired output by working the power mixers in two shifts, reducing the cost from 50 cents to \$1 per yard while securing a more uniform product. By doing its concrete work in this way the road has effected important economies directly and has also been able to compete with contractors and secure better prices from them. As far as possible, the concrete gangs are worked in the same manner as the rail and ballast gangs, being employed on the northern division in the summer and south during the winter.

All painting is done by the bridge and building forces under the direction of the local division supervisors. An extensive campaign to push the work has been conducted during the last few years until now the buildings are well painted. The delayed work has now been so nearly completed that one small gang can do the necessary work on each division. These gangs are employed throughout the year, doing exterior work during the summer and interior work in the winter.

Each division has one or more bridge inspectors reporting to the general foreman of bridges and building, who examine all bridges and report promptly any structures requiring attention. A sufficient number of inspectors is employed to permit all structures to be examined monthly, four being required on the Northern division.

The division general foreman, accompanied by the district engineers and the division superintendent, makes an annual inspection of all bridges and culverts on his territory, traveling by motor car or train. All metal bridges are also inspected by men from the office of the chief engineers at regular intervals.

All stations are constructed by company forces. These buildings are built to a recently adopted standard, of hollow tile walls and fireproof construction. Five of these buildings were built last year and others are now under construction.

OTHER METHODS

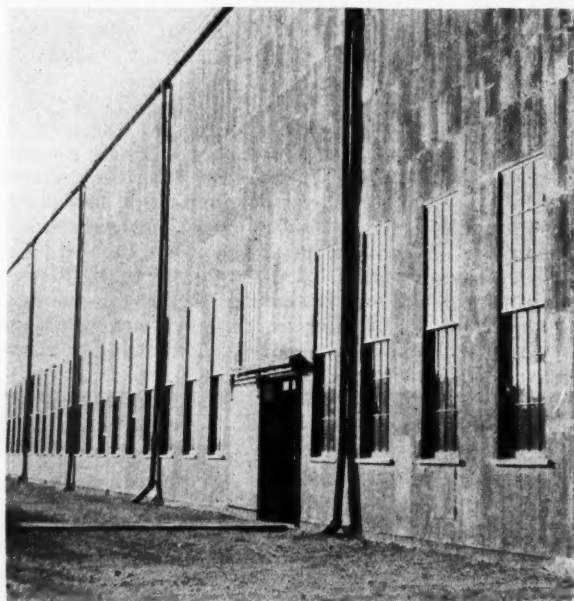
The right of way has been mowed twice yearly for the last four years, the first time in May or June and the second in August or September. In the fall the weeds are also burned. By these measures the weeds are being killed to a large extent and grass is taking its place, materially improving the appearance of the right of way.

Although many of the lines were without cattle guards a few years ago, they are now well provided as the re-

sult of special attention to this subject. A wooden picket cattle guard is installed which is built from old car siding and roofing lumber which would otherwise be scrapped. It is made at the company shops at Springfield, a foreman and 9 men turning out 55 complete sets ($\frac{1}{2}$ crossing) per day at a cost of 62 cents per set. These cattle guards are whitewashed readily and are easily installed and repaired by the foremen.

Instead of sending a special gang over the line to whitewash these cattle guards, wing fences, and fences about stockyards, etc., the section forces are given the necessary materials and are required to go over these fences whenever needed as a part of their regular duties.

The road is now going into the use of concrete signs rapidly and expects soon to take up the use of concrete posts for right of way fences. The signs, some of



BUILDING COVERED WITH OLD MURPHY CAR ROOFING

which are shown in the photographs, are cast at a yard at Amory, Miss. The letters are recessed in the concrete and are painted with black asphalt, which shows up distinctly against the light background. At present some of these signs cost more than wood and others less, but the average cost of all shows a saving over wood. The greatest economy will be in the cost of maintenance. At present the wooden signs are given two body coats of paint, in addition to the lettering, every two years. As the signs average about five per mile, it is estimated that the complete installment of concrete signs will save \$13,000 per year in maintenance alone. In placing roadway signs, special emphasis is placed on the signs being vertical and well maintained in the belief that if work which can be seen is well done, other work which is not so readily visible will be handled similarly.

Starting in February, 1916, all maintenance of way accounting has been handled through the general manager's office to secure uniformity and to consolidate the work. In this way it is also possible to provide the general manager and also the general and division superintendents with data regarding their expenditures more promptly.

A supply car is run over the line monthly to distribute the material needed for current operations. No accumulation of material is allowed on the line or at the road-

master's headquarters. Close attention is also given to the collection of scrap along the line. The rules require that a foreman shall not pass a piece of scrap lying along the right of way, but must pick it up and take it to the tool house. Cars are run on the local freight trains at regular intervals to collect the scrap from these points. In this way the right of way is kept clean of debris at all times of the year.

Starting a year ago, safety first inspectors are appointed in the maintenance of way and other departments each year, each man working among the men in his branch of service. These appointments are for periods of six months to one year and at their expiration the men return to their former work and are succeeded by others. In this way each branch of the service will soon contain a number of men trained in safety methods. It is found that they have more influence among their associates than men from other departments. While engaged in this work these men devote their entire attention to the elim-

ination of dangerous practices and the correction of hazardous conditions.

A system reclamation plant is maintained at Springfield to which a large amount of track material is sent to be worked over. Among other things, track spikes are straightened, annealed and classified for main, yard and side tracks. Guard rails are made out of scrap rails. Track wrenches are made out of engine tires and other scrap material. Angle bars are reclaimed by plugging the old holes and punching new ones to correspond to the drilling of rail being laid on branch lines. Motor and hand cars are also repaired at this plant.

Much material is also converted into other uses. As an instance, a large tank car shop was built at Springfield two years ago with the sides and roof of old Murphy car roofing. At this same shop an overhead traveling crane moved from another shop was supported on a runway carried on vertical steel posts recovered from a bridge.

Teredo Ruins Poorly Treated Piles

SOME Douglas fir piles, supposedly treated with creosote, were so badly riddled by the teredo after eight or nine years of service at Tacoma, Wash., as to necessitate their removal. Two sections of these piles were sent to Dr. Herman Von Schrenk, consulting timber engineer at St. Louis, Mo., who has made a thorough investigation of them. This led to an interesting report which is abstracted in part below.

The piles were cut into sections at various points and a careful examination was made to determine the depth of penetration of the preservative as indicated by the dark stain on the wood. This showed that the average

of the whole pile, was only 3.32 lb. A second extraction showed 22.3 per cent preservative, equivalent to 7.04 lb. per cu. ft. of the treated wood, or 2.2 lb. per cu. ft. for the whole pile.

A chemical analysis indicated that in all probability the preservative was strictly of coal tar origin, unadulterated by water-gas tar or other materials. However, the amount of oil with which these piles were treated was obviously too small. It should be remembered that treating specifications usually require a certain number of pounds per cubic foot, based on the total volume of material treated. In other words, piles in the Puget



TWO EXAMPLES OF BADLY EATEN PILES

penetration was from 1 in. to $1\frac{1}{4}$ in., although in a few places it was only nominal, and at one or two points there was practically no penetration at all. The holes made by the teredo were smallest in the creosoted portions, increasing in size toward the central portions of the piles.

Holes were bored in the piles at various points and an examination of the borings indicated that apparently there was more preservative at certain portions of the circumference than at others. The oil was extracted from some of these borings, indicating 34 per cent by weight of preservative, or 10.88 lb. of preservative per cubic foot of wood. Calculating the actual amount of treated wood and taking the whole volume of the pile, the amount of oil per cubic foot, based on the volume

Sound district, in order to give anything near proper protection, should have at least 15 to 20 lb. per cu. ft. In view of the fact that only a thin layer of Douglas fir can be treated around the outside, it will readily be seen that the actual amount of oil injected in the portion which is treated would be far in excess of 15 or 20 lb. per cu. ft. or the stick should be treated practically to refusal. This was certainly not the case with the two piles submitted for examination.

While the penetration was fairly good at most points, there were numerous weak spots at the circumference, where the penetration was extremely small. On the photographs there are points where practically no creosote is visible, and where even the microscope did not disclose any.

CONCLUSIONS AND RECOMMENDATIONS.

The conclusion reached from this investigation is that the piles were so badly decayed and destroyed by the teredo because (1) the amount of oil injected was entirely insufficient to give proper protection, and (2) because the piles were probably not correctly treated, since otherwise they would have been given a far better and more uniform penetration.

The lesson to be drawn from an investigation of this kind clearly establishes that, for successful resistance to the teredo, Douglas fir piling should be air dried, wherever possible, instead of being subjected to the usual boiling treatment. This will very largely obviate the leaving of vulnerable untreated spots in the circumference of the stick and will at the same time insure a far



A GOOD PENETRATION OF CREOSOTE

greater depth of penetration and the retention of a larger volume of oil than is usually obtained. Piles can be air-seasoned successfully in the Puget Sound district, and the resultant treatment is so much superior that there can be little doubt as to the advantage to be gained by this practice. One of the photographs shows two sections of creosoted Douglas fir piles cut 12 ft. from the end. These piles were treated after having been thoroughly air-seasoned and a very uniform penetration of the sap rings was secured can be noted clearly in the pictures.

The present system of specifying treatment on the basis of so many pounds per cubic foot is a very poor standard for material like Douglas fir piles. Where a railroad goes to the expense of having material treated, it would be far better if a specification called for a certain depth of penetration, irrespective of the quantity of oil injected to obtain it, and make the actual oil used in the treatment the basis of payment. It might be advisable to provide an upper limit for the amount of oil allowable, such a limit to be determined from experience. The investigation also indicates that the inspection of piles of this kind must be carried out by actual borings of a large number of the sticks and that the method of inspection by which the quantity of oil absorbed is judged by gages or other readings is not sufficient.

THE OCTOBER CONVENTIONS

As announced previously, conventions of two other important maintenance of way organizations will be held during the month of October. The American Railway Bridge and Building Association will hold a convention at the Hotel Sherman, Chicago, Ill., on October 18 to 20, while the Maintenance of Way Master Painters' Association will hold a meeting on the same dates at Cleveland, Ohio. The complete program of the Bridge and Building Association convention appeared in the September issue of the *Railway Maintenance Engineer* and from reports received from various parts of

the country a well attended meeting is anticipated. The program of the Master Painters' convention is as follows:

PROGRAM

TUESDAY, OCTOBER 16, 10:00 A. M.

Call to Order, opening exercises and reports of officers.

2:00 P. M.

Paper—Painters and Painters, by C. F. Loweth, chief engineer, Chicago, Milwaukee & St. Paul, Chicago, Ill.

Paper—Interior Wall Coatings, by C. H. Hall, general superintendent, Patton Paint Co.

Committee Report—Methods Employed in Protecting the Public from Paint During the Renovating Period. H. B. Wilson, master painter, Bessemer & Lake Erie, Greenville, Pa., chairman.

WEDNESDAY, OCTOBER 17, 9:00 A. M.

Committee Report—The Painting of Water Tanks, by Bert E. Darrow, master painter, Atchison, Topeka & Santa Fe, Kansas City, Mo., chairman.

Open Discussion—The Painting of Danger Lines on Station Platforms.

Paper—The Volume of Maintenance of Way Painting, by W. S. Lacher, managing editor, *Railway Maintenance Engineer*, Chicago, Ill.

THURSDAY, OCTOBER 18, 9:00 A. M.

Committee Report—The Painting of Bridges, by H. S. Bird, master painter, Philadelphia & Reading, Philadelphia, Pa., chairman.

Paper—The Finishing of Floors, by H. B. Wilson.

Paper—Efficiency, Economy and Safety First, by H. F. Jones, master painter, Big Four, Wabash, Ind.

2:00 P. M.

Paper—Metal Protection, by Philip L. Maury, the Sherwin-Williams Co., Cleveland, O.

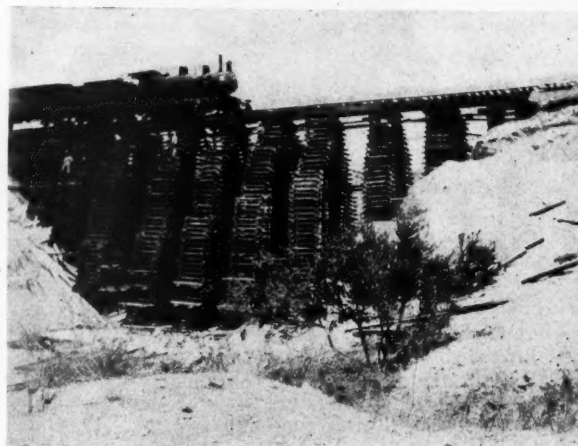
Committee Report—Material and Labor Reports, by W. I. French, master painter, New York, Ontario & Western, Middletown, N. Y.

Answers and Discussions of Questions.

Closing Business.

EMERGENCY TRESTLE CONSTRUCTION

THE departure of the railway regiments for France to undertake the rehabilitation of portions of the French railways lends interest to instances of rapid reconstruction work like that shown in the accompanying



TRESTLE BUILT IN 16 HOURS

photograph of a trestle which was rebuilt in an unusually short time on a southwestern road. The original structure at this point was a timber trestle 165 ft. long and 53 ft. high. It was burned several years ago and was rebuilt by railway forces in the manner shown in the short period of 16 hours. The crib was built of 6,000 ties so placed that pile bents could be driven between them later. This material was used to avoid the delay in waiting for piles and to hasten the completion of the work, as more men could be worked with this form of construction.

THE BONUS SYSTEM FOR MAINTENANCE WORK

The First of a Series of Articles Describing the Principles
of This Plan and Their Application

BY W. C. NISBET

THE development of wage systems has been going on since one man first worked for another. Therefore, to get a clear conception of the reason for present systems, it will be worth while to sketch the various changes. The first method of paying workmen was to furnish board, clothing, shelter and necessities, as was done with slaves. No money was paid and no fixed task was set. As civilization developed it was found to be cheaper to hire a man by the day when needed and keep him as long as required, paying him wages and allowing him to provide his own sustenance. With some variations, such as monthly payments, in certain cases and allowing board in others, this was the general method of wage payments up to 30 years ago, and is still the common manner of paying most maintenance of way workers.

In industrial work this method was very successful where each employer worked only a few men and was in effect a working foreman, thus setting the pace and supervising the work of each individual. He could thus reward the diligent, teach the beginners, discharge the lazy and enforce a satisfactory standard of workmanship.

As plants and working forces grew larger supervision was delegated by employers to superintendents and foremen, and evils of various sorts began to multiply. As authority was passed down step by step unit costs increased and there was greater difficulty in being sure that workmen returned value received for wages paid. As a measure of self-protection, piecework began to be applied to industrial plants of various kinds and to railway locomotive and car shops. By this plan a man receives no day wages, but does various jobs or tasks for established prices.

IT HAS ALWAYS BEEN THE ATTITUDE IN THE MAINTENANCE OF WAY DEPARTMENT THAT ONE MAN IS AS GOOD AS ANOTHER. THIS HAS RESULTED IN THE PAYMENT OF A FLAT WAGE RATE FOR ALL MEN IN A GANG AND FOR ALL GANGS. FARTHER, MOST FOREMEN GOT THE SAME WAGES. THE AMBITIOUS MAN RECEIVED NO COMPENSATION FOR EXTRA EFFORTS, AND HE WENT TO OTHER INDUSTRIES WHERE THIS CONDITION DID NOT PREVAIL. THIS CONTINUAL LEVELING DOWNWARD OF MAINTENANCE FORCES HAS CONTRIBUTED IN A LARGE MEASURE TO THE PRESENT INEFFICIENCY AND SCARCITY OF LABOR.

THE PAYMENT OF SPECIAL COMPENSATION FOR EXTRA EFFORT IS NOT NEW IN INDUSTRIAL MANAGEMENT. NEITHER IS IT ENTIRELY NOVEL ON THE RAILWAYS. HOWEVER, UNTIL ABOUT SIX YEARS AGO NO ATTEMPT HAD BEEN MADE TO APPLY ANY SUCH SYSTEM TO THE PROBLEMS OF THE MAINTENANCE OF WAY DEPARTMENT. IN 1911 THE BALTIMORE & OHIO INSTALLED A FORM OF THE BONUS SYSTEM APPLICABLE TO TRACK WORK ON ONE DIVISION AND HAS SINCE EXTENDED IT OVER A LARGE PART OF ITS LINES. OTHER ROADS ARE CONSIDERING FAVORABLY THE ADOPTION OF SIMILAR PLANS.

THE BASIC IDEAS OF THE BONUS SYSTEM HAVE MUCH TO COMMEND THEM TO MAINTENANCE WORK. THE CRITICISM WHICH HAS BEEN DIRECTED TOWARD THESE IDEAS HAS RESULTED LARGELY FROM A LACK OF KNOWLEDGE OF THE DETAILS OF THE PLAN AND OF ITS EXECUTION. THE SERIES OF ARTICLES, OF WHICH THIS IS THE FIRST, WILL DESCRIBE THESE PLANS AS THEY ARE APPLICABLE TO TRACK WORK, AND SHOULD AID IN CLEARING UP THE MISUNDERSTANDINGS WHICH NOW EXIST.

THE AUTHOR IS A PRACTICAL RAILWAY MAN WHO HAS SPENT 10 YEARS IN THE MAINTENANCE OF WAY DEPARTMENT OF THE PENNSYLVANIA LINES, AFTERWARD GOING INTO INDUSTRIAL ENGINEERING IN DIFFERENT MILLS AND SHOPS, WHERE HE HAD TO DO WITH VARIOUS INCENTIVE FORMS OF WAGE PAYMENT. LATER HE WAS CLOSELY IDENTIFIED WITH THE BONUS PLAN ON THE BALTIMORE & OHIO, AND MORE RECENTLY WITH SIMILAR STUDIES ON OTHER EASTERN ROADS. HE HAS THEREFORE HAD AN OPPORTUNITY TO FAMILIARIZE HIMSELF WITH THE DETAILS OF TRACK WORK AT FIRST-HAND AND LATER TO APPLY THIS KNOWLEDGE TO THE APPLICATION OF THE BONUS SYSTEM IN A PRACTICAL MANNER.

While this practice set the manager at rest as to the direct cost of the job and is the most common method of wage payment in shops and factories, it has some decidedly unsatisfactory features. If, through no fault of the workman but because of delay by a traveling crane, belt breakages or lack of air pressure, he is delayed and cannot work continuously, he suffers. If he is a careless or incompetent workman and breaks or otherwise spoils his work he also suffers and the company suffers, too, for the workman is occupying the space and using the machine which should be producing to its capacity.

If the job was to put a pair of new wheels into a freight car truck, various conditions might prevent quick work, as for example, a blocked track, bad weather, long distances to go to get jacks or other tools, nuts rusted tight, etc. Where the worker was dependent entirely on the number turned out for his income he might be able to earn only half of the amount necessary to live upon and often his only redress is to quit. He is in the position of a contractor who undertakes to do a piece of work for a fixed sum, but has little or no control over the conditions governing his output. The result is naturally unsatisfactory.

Another condition common in piecework, though not necessarily an accompaniment thereof, is that it has been common to fix the price arbitrarily at so much a piece or a job with little relation to the real possibilities. If a hard-worker or an especially skilled workman made high wages thereby, it has been common to cut the rate which, if repeated, arouses suspicion and teaches the workman to restrict his earnings to an amount he supposes will not be objected to, even though the interests of his employers may require the highest output possible.

With the purpose of avoiding the evils of piecework and at the same time retaining the valuable principle of increased pay for increased production, the method of paying employees, called standard time and bonus, was devised, which has been largely used for the last ten years in railway and industrial shops and is now being extended successfully to maintenance of way work. The worker receives a fixed sum per hour or per day, as in day work, and a bonus in addition thereto in proportion as he approaches or excels the standard time set as a reasonable time to do each particular job.

For example, suppose the standard time for painting a small building 1 coat by 1 man to be 10 hrs. and the man's day rate is 30 cents per hour. If he does the job in 10 hrs. he earns 10×30 cents = \$3.00 wages. Assuming that this is a 100 per cent performance and that this earns a 20 per cent bonus:

10 standard hrs. _____ = 100%, which pays 20% bonus, or \$0.60.

10 actual hrs.

Total \$3.60, or \$0.36 per hr.

If he does the job in 9 hrs. he earns 9×30 cents = \$2.70 wages, 10 standard hrs.

_____ = 111%, which pays 20% bonus, or \$0.84.

9 actual hrs.

Total \$3.54, or \$0.39 per hr.

It is to be noted that in spite of the fact that the man made 3 cents more per hour in the last case than in the first, the employer got the work done for less (\$3.54 instead of \$3.60).

The advantages over piecework are: (1) No matter if conditions make a considerable output impossible, the worker does not suffer any hardship, but continues to receive his day rate, which is usually the same as is commonly paid day workers for the class of work done in the locality in question, and (2) with increased output which is frequently due to improved conditions or to careful training of the men in the best methods of work, both at the expense of the employer, the company and worker share the profits. With piece rates the cost per unit of work to the company would remain the same and the worker would get the whole gain.

The bonus percentages range from 0 per cent for 66 per cent performance to 10 per cent for 90 per cent performance. Above 90 per cent the bonus per cent increases 1 per cent for every 1 per cent increase in performance, as 11 per cent bonus for 91 per cent performance and 45 per cent bonus for 125 per cent performance.

BONUS TABLE.

Performance Per Cent	Bonus Per Cent on Wages	Performance Per Cent	Bonus Per Cent on Wages
66%	.01	84	5.55
68	.04	85	6.23
69	.01	86	6.93
70	.02	87	7.63
71	.35	88	8.40
72	.55	89	9.20
73	.75	90	10.00
74	1.00	91	11.00
75	1.31	92	12.00
76	1.61	93	13.00
77	1.99	94	14.00
78	2.39	95	15.00
79	2.80	96	16.00
80	3.30	97	17.00
81	3.80	98	18.00
82	4.34	99	19.00
83	4.95	100	20.00

As track work is in most cases the result of the joint effort of several men, the performance per cent for the entire gang is used in getting the bonus per cent which is applied to the earnings of each man.

It happens that the percentage method used in Standard Time and Bonus is especially convenient for recording gang performance and computing gang bonus. Fur-

ther, the bonus percentage of the gang is the bonus percentage of the foreman, and is applied to his salary for the pay period, giving him a welcome opportunity to share in the reward for rapid and effective work.

It is found in practice that the foreman's bonus feature is one of the greatest advantages of this plan. As faithful and effective a worker as the American track foreman is known to be he will respond to the stimulus of knowing that his daily performance is being recorded and compared with others and that thought and ingenuity in devising better and quicker methods of doing his work will receive immediate financial reward.

If some of the men in a gang are absent for part of a pay period the matter works out just as simply, the bonus percentage of the gang being applied to whatever wages each man draws. To illustrate, consider a gang working on tie renewals for a pay period of 13 working days and consisting of a foreman and 6 men for 13 days and 1 additional man for 7 days in the period. Suppose the standard time for putting in a tie to be 1 man hour, including an allowance for the foreman's supervision, and that 900 ties were put in; the standard time allowance would then be 900 hours and the actual hours 980.

900 standard hours _____ 92 per cent which pays 12 per cent

980 actual hours

bonus.

If the foreman received \$75 per month and the men

\$2 per day, they would get the following pay:

Foreman, $\frac{1}{2}$ month \$37.50 + 12 per cent (\$4.50) = \$42.00
 Each of 6 men working 13
 days at \$2 \$26.00 + 12 per cent (\$3.12) = \$29.12
 1 man working 7 days \$14.00 + 12 per cent (\$1.68) = \$15.68

It is recognized that actually a gang would not work 13 days doing only tie renewals, but with standards set for each kind of work done, the same method of comparing the actual and standard hours is followed no matter how many kinds of work are done, and all the results are combined.

For several reasons a daily work and time report is advantageous and should be used with this system so that the records may be kept up to date and not fall entirely at the end of the pay period. Further, this allows the roadmaster to have daily performance reports so as to know how closely each gang is attaining the standards.

A good type of daily work and time report has a space on one side of the page for writing the men's names and the hours each man has worked. On the reverse side of the sheet is a list of the principal operations in track work with one column to show the number of units of work done and another column to show the hours of work to be charged to each item, as:

Item	Number	Hours of work
No. 1 ties put in.....	90	100
100-lb. rails laid	1	5
Bolts tightened	200	5

To have the items already printed saves writing on the part of the foreman, reduces errors and makes the final recording easier.

It is recognized that in any of the incentive methods of payment increased inspection is necessary. While some men work just as well when striving to increase output, others will not. This need is not so imperative with the standard time and bonus plan as in piece work, because in the former the men get their regular day rate and the foreman receives his monthly salary in any event. With piece rates the need for regular earnings is so urgent that the worker is forced by necessity to get at least a living wage every day, and he will do it by some means or quit.

It is recommended that when the standard time and

bonus plan is introduced, track inspectors be appointed to keep the records, see the work performed, note what schedules to apply and observe how the work is done.

The roadmaster, however, is the real judge of the quality of the work and if it is not done properly it should be done over without any standard hours being allowed. One such track inspector assigned to each roadmaster can usually handle the work if there are good facilities for getting over the district and seeing the work on the ground. He must check the foreman's daily reports with what he sees on the track to vouch for their accuracy and to know what schedules to apply in crediting each gang with the proper number of standard hours.

Track inspectors may be chosen from the "practical school," such as extra gang or work train foreman, roadmaster's clerks, etc., if they can handle the clerical and accounting features, percentages, etc., most easily done with a slide rule, or from engineers of the transitman grade who can be trained to know the maintenance features. The experience any of these men get in this position will greatly increase their value to the railroad.

SAVINGS TO BE DERIVED

It is the result of experience that without the stimulus of keeping a record of the performance of individual gangs, and without any incentive system the average output will not be over 50 per cent to 60 per cent of what may be attained by using records, standards and incentives. We will take the latter figure and assume that the ordinary average performance is 60 per cent, while the attainment possible by competitive records, supervision, standard times, standard methods and bonus payments will ultimately reach 100 per cent. To do this will perhaps require three to four years, and to be conservative we will assume that only 95 per cent of standard is attained on the average. This calls for the payment of 15 per cent bonus. The result is a gross profit of 27 per cent on the track labor pay roll, from which it will be necessary to deduct 2 per cent for the services of the track inspector, traveling inspectors to check up the latter, stationery and miscellaneous expenses. The net profit to the railroad company should be therefore a saving of 25 per cent of the track labor pay roll.

TRACK WORK ON THE WAR FRONT

WHILE much has been said concerning the men and organizations that have gone to France to conduct railway operations for the American army, the average laymen has but a vague conception of the work which railway troops carry on. For this reason an account of the work being done for the British forces by the First Canadian Overseas Railway Construction Battalion, which appeared in a recent issue of the Canadian Railway and Marine World, is of special interest and is abstracted below.

Recruits were taken everywhere, from the territory between Halifax and Winnipeg, a few men coming from Edmonton and other western centers. Recruiting was completed on July 20, 1916, and after intensive training the detachment sailed on September 13, arriving in France on October 28. The battalion is commanded by Lieutenant Colonel Blair Ripley, formerly engineer in charge of track elevation work for the Canadian Pacific at Toronto, Ont. The organization consists of four companies, each commanded by a major, a captain and four lieutenants.

The battalion includes 6 warrant officers, 52 staff sergeants and sergeants, 89 corporals and 40 lance corporals, making a total strength of 1,065 all told. The transport consists of 10 riding horses, 100 teams of mules, 2 motor

cars, 8 light motor trucks, 9 heavy motor trucks, 4 field kitchens, 4 water carts, etc. The equipment consists of practically the same articles that would be used in Canada under peace conditions. Each company and headquarters is furnished with first-class engineering and surveying equipment, and each carries a regular survey party. The tools comprise practically everything that is necessary in building a road bed, culverts, bridges, and buildings and the tracklaying and ballasting of a railway, and the size of the outfit can be judged from the fact that it took three trains, totaling 130 cars, to move the battalion from its former location in France to its present site. The battalion's headquarters staff is quartered and moves about in railway cars that have been fitted up specially for the purpose. These comprise an office car, an orderly room car, in which the battalion's regular business, including the preparation of plans and reports, etc., is carried on; tool car, mess car, cook car and two sleeping cars. The battalion also carries with it a pile driver, which was built in France. The majority of the men live in tents, but comfortable huts are being acquired to carry about with the battalion when conditions permit. They are collapsible and are easily taken down and set up again.

When the battalion first arrived in France it was put on the double tracking of an existing standard gage line and in the extension of station yards and terminals. In addition to laying track, putting in switches, ballasting, etc., the men moved 34,000 cu. yd. of earth, and the whole work was done in 28 days. There was rather a novel experience on this work, in connection with putting in a water supply. It was necessary to lay 30,000 ft. of 6-in. pipe line and to pump the water against a head of nearly 300 ft. The pumps and other material were secured quickly and the excavation for the laying of the mains and the elevated water tanks were started at once. It was explained to the men that the work must be completed in less than two weeks' time, and notwithstanding the terrible weather encountered, the system was in operation on the tenth day.

During last winter the battalion handled the maintenance of more than half of the light railways on the western front in addition to the construction of the advance lines. Six light railway construction and maintenance companies of 250 men each were organized and worked with the battalion, under its instructions on this work.

The importance of light railways and the difficulties of maintenance and construction, should not be under estimated. Some of them were built in summer when the ground was dry, and when it was possible to operate them without ballast, and when winter came on, the maintenance became a very difficult matter. In some cases it took 20 men per mile. For ballast, brick from ruined towns and villages is hauled in and tamped under the steel ties, and where ballast is not obtainable, it is necessary to salvage boards, pieces of planks, sheets of galvanized iron, or whatever is available, to be laid longitudinally under the track to keep it from sinking into the mud, so that operations can be carried on and rations and munitions carried up to the men at the front. A good deal not only of construction but also of maintenance had to be done at times when weather conditions would not permit the enemy's viewing the battalion, otherwise heavy casualties would have resulted. This necessitated the doing of considerable work at night, and the choosing of dull and foggy days, which were not uncommon, for the rest. The lines of course were built as far as possible so as not to be under observation, but this could not always be done.

Last spring, when the German retreat began, the bat-

talion was at once taken off the light railways and put on standard gage lines. The battalion was very short of equipment on this work, and notwithstanding the fact that it had only 6 spike mauls of the regular pattern to put in the spikes, an average of a mile a day, including grading and track laying, was completed. A total of

about 60 miles of line was laid at this time, the larger portion of which is double track, and is on a line of such importance that it was ballasted with crushed rock. A large volume of traffic is being carried over it. It was blown up in one or two places by the enemy during construction, but was quickly repaired without casualties.

Building Culverts for Future Tracks

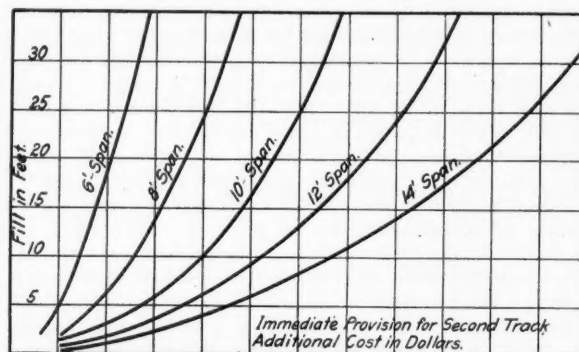
WITH the introduction of the flat top or rectangular culvert, built of reinforced concrete or of rails or beams imbedded in concrete, the feasibility of proportioning the cover of the culvert according to the load which it has to carry, has resulted in a rather general practice of decreasing the thickness and strength of the culvert cover with the distance from the center line of track or the deeper part of the embankment. Thus the portion near the center of the embankment is designed to carry the full height embankment with some allowance for the live loading, while the portions next to the parapet are designed to carry but little more than their own weight.

This practice, however, leads to difficulty when it becomes necessary to widen the embankment to provide for additional tracks, as when a line is double tracked or passing tracks are extended, as the outer portion of the cover is too weak to carry the additional loading and must be reinforced. This becomes an expensive undertaking, as it is necessary to drive falsework to support the existing track while a considerable portion of the embankment is excavated and the culvert cover is reinforced. The reinforcement ordinarily consists of the addition of a new concrete slab on top of the old one.

This process is very much more expensive than provision for additional tracks at the time the culvert is built and some railroads follow the latter policy, partly

vestigation was made by one of the roads in the Middle West to determine the relative cost of immediate and deferred provision for additional tracks. Estimates were made for culverts of various sizes and depth of filling on the basis of the two typical estimates given below. These estimates formed the basis for the two diagrams showing the cost for the various widths of opening and heights of the embankment.

In the cost of immediate provision it was assumed that the additional strength of the cover would have to be provided on each side of the existing track on the as-



COST TO PROVIDE FOR SECOND TRACK NOW

Box culvert, 10 ft. by 6 ft., 29-ft. fill.

Additional cost of provision for two extra tracks when culvert is built:

12 cu. yd. of concrete at \$6	\$ 72
1,900 lb. of steel at \$0.03	57

Total

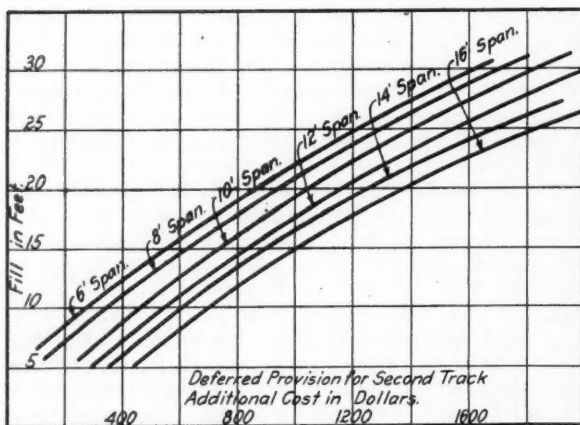
Forms (same).

Per cent of total cost, 4.85.

Cost of alterations to provide for a second track after culvert and fill are complete:

22 cu. yd. of concrete at \$6	\$ 132
2,700 lb. of steel at \$0.03	81
Falsework, 3 spans	550
Excavation and fill, 325 cu. yd., at \$3	975

Total



COST TO PROVIDE FOR SECOND TRACK LATER

for this reason and partly because of the simplicity of the design when the entire length of the cover is of uniform section. The strength of the side walls and footings of the culvert ordinarily do not need to be taken into consideration because the side walls usually present a much higher factor of safety than the covers. On the other hand, the footings can be underpinned to provide additional footing area at any time at a nominal cost and without any interference with train operation.

In order to ascertain just what would be the most economical policy in the construction of culverts, an in-

sumption that the location of the future track would not be known. In the case of the cost of deferred provision, it is assumed that the cover would be strengthened only on the side where the track was actually built.

With the help of these diagrams, estimates were made for the immediate and deferred provision for double track on 59 box culverts on a 100-mile stretch of main line, the spans of these culverts varying from 4 to 16 ft. and the depth of fill from 3 to 36 ft. From this it was found that the covers of all these culverts could have been made strong enough to provide for an additional track on each side for a total cost of \$4,742. On the other hand, to uncover these culverts after they had been completed and strengthen the covers on one side would cost \$40,560. If we compound \$4,742 at 5 per cent

annually it will amount to \$40,560 in 44 years; in other words, immediate provision for additional tracks was justified if the line should be double tracked any time within 44 years.

From this it would seem conclusive that immediate provision should be made. However, on account of grade reductions which frequently accompany authority for second track, changes of line are frequently made which eliminate many of the old culverts from the new work. Therefore, the matter should be considered in another way:

\$4,742 at 5 per cent compounded annually = \$7,725 in 10 years.

\$7,725 divided by \$40,559 = 19 per cent.

\$4,742 at 5 per cent compounded annually = \$12,580 in 20 years.

\$12,580 divided by \$40,559 = 31 per cent.

In other words, immediate provision is justified if the line will be double tracked within 10 years with at least 19 per cent of the old culverts utilized in the reconstructed line, or if it is double tracked within 20 years with the utilization of at least 31 per cent of the old culverts.

These figures are, of course, subject to variation with the sizes of the culvert and the heights of fill. It is clear, however, that the cover of the culvert should be of sufficient strength to provide for the additional future track if there is any reasonable assurance that it will be required. This leads to the conclusion that this matter should receive individual consideration for each culvert, taking into account the possibility of double tracking or passing track extension and the possibility of the use of the old alignment in the event of such future work.

CONCRETE FLOOR SPECIFICATIONS

THE Portland Cement Association has issued a bulletin containing suggested specifications for concrete floors. These are complete as to all details of material and workmanship and cover reinforced concrete floors and plain concrete floors with and without concrete bases. The following clauses abstracted from these specifications cover the requirements of materials, workmanship and the protection necessary to secure surface finishes of good quality.

Mixture No. 1: The mortar shall be mixed in the proportions of one sack of Portland cement and two cubic feet of fine aggregate. The minimum thickness shall be $\frac{3}{4}$ in. Mixture No. 2: The mortar shall be mixed in the proportions of one sack of Portland cement, one cubic foot of fine aggregate and one cubic foot of No. 1 aggregate for wearing course. The minimum thickness shall be one inch.

No. 1 aggregate for the wearing course shall consist of clean, hard, tough, crushed rock or pebbles, free from vegetable or other organic matter, and shall contain no soft, flat or elongated particles. When dry it shall pass a screen having $\frac{1}{2}$ -in. openings and not more than ten per cent shall pass a screen having four meshes per linear inch.

The mortar shall be of the dryest consistency possible to work with a sawing motion of the strikeboard.

The wearing course shall be placed immediately after mixing. It shall be deposited on the fresh concrete of the base before the latter has appreciably hardened, and brought to the established grade with a strikeboard.

When placing the wearing course after the concrete slab has hardened, eliminate the paragraph above and substitute the following: The surface of the slab shall

be thoroughly roughened by picking, and swept clean of all dirt and debris. The slab shall be thoroughly moist but free from pools of water when the grout and mortar for the wearing course are placed. A neat cement grout shall be brushed on the surface of the slab, the wearing course applied immediately and brought to the established grade with a strikeboard. Grout and mortar shall be used within 45 min. after mixing with water. After the wearing course has been brought to the established grade by means of a strikeboard, it shall be worked with wood float in a manner which will thoroughly compact it and provide a surface free from depressions or irregularities of any kind. When required, the surface shall be steel-troweled, but excessive working shall be avoided. In no case shall dry cement or a mixture of dry cement and sand be sprinkled on the surface to absorb moisture or to hasten the hardening, but the Bruner method may be used if desired.

As soon as the finished floor has hardened sufficiently to prevent damage thereby, the floor shall be covered with at least one inch of wet sand, or two inches of sawdust, which shall be kept wet by sprinkling with water for at least 10 days. The freshly-finished floor shall be protected from the hot sun and drying winds until it can be sprinkled and covered as above specified. The concrete surface must not be damaged or pitted by raindrops, and there shall be provided and used when necessary sufficient tarpaulins to completely cover all sections that have been placed within the preceding 12 hours so that they will be thoroughly protected.

AN ILLUMINATED CROSSING SIGN

IN a recent discussion of the problem of safety at grade crossings of highways with railroads it was suggested that the best safeguard available was a cautionary signal or marker showing the exact location of the railroad



THE SIGN BY DAY AND NIGHT

crossing at all times and to do away entirely with all warning signals that announce the definite approach of a train. A scheme whereby this idea may be carried into effect with a minimum of new equipment is illustrated in the accompanying photographs, one of which

shows the ordinary crossing sign as seen in the day time and the other showing its aspect at night when illuminated

by an electric light placed just above it three feet in front of the post. This installation is on the Baltimore & Ohio.

Concrete Cottages for Railroad Employees

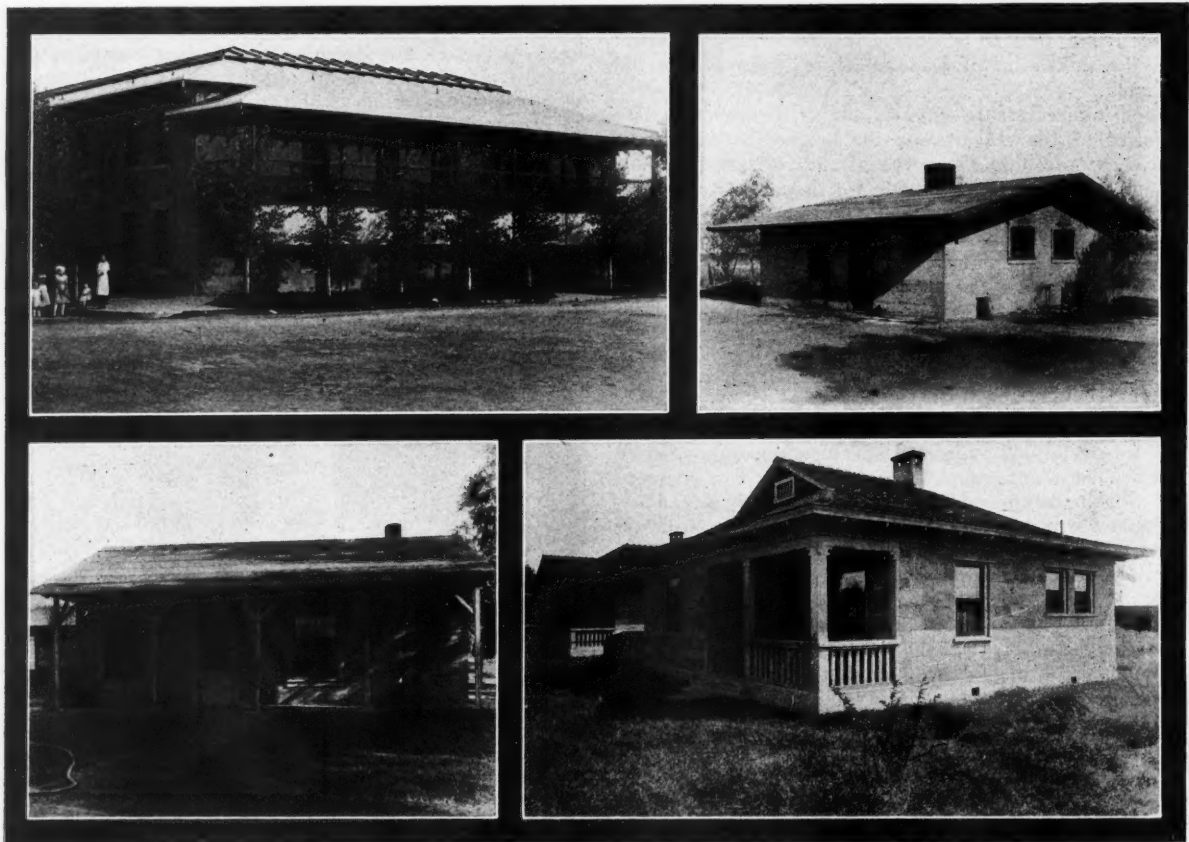
FEW railroads have attempted a solution of the housing problem as it relates to their employees by using concrete as extensively as the Los Angeles & Salt Lake, which has constructed cottages for section foremen and laborers and for other employees on various points on its line, according to standard plans, using monolithic concrete in some cases, and in others, concrete block.

In 1910, the company built for shop employees in Las Vegas, Nev., 20 four-room and 20 five-room concrete cottages with shingle roofs. The average cost of these was \$1,650 for the four-room and \$1,800 for the five-

heat, laundry, baths and other modern sanitary appointments. The cost approximated \$28,000.

Other photographs show various types of quarters provided for section laborers and section foremen. Between Los Angeles and Riverside these houses are of monolithic concrete with composition roofs. On the desert, between Daggett and Caliente, a slightly different type of house was adopted, the principal change being the addition of a patio for ventilation.

The company purchased a concrete block-making machine in 1909, which manufactures a type of block that enables a wall to be built with a continuous air space



TYPICAL EXAMPLES OF THE CONCRETE HOUSES

room cottages. While simple, the plans provide the recognized conveniences of the modern well-appointed home, including a bath room. In 1911, work was started on 12 more four-room and 12 five-room cottages on the same plans. In this second lot there was a slight reduction in the cost. The four-room cottages cost an average of \$1,600 each, while the five-room averaged \$1,750 each.

One of the photographs shows a concrete rooming house built for the accommodation of single men employed at the company's shops in 1911. It is two stories high, contains 32 rooms, is roofed with composition material, has a sleeping veranda, and is equipped with steam

throughout. The particular advantage of this type of block lies in the fact that the resulting hollow wall introduces insulation in the wall through this dead air space. This prevents extremes of heat and cold on the exterior from materially affecting the temperature within the structure.

An important advantage of concrete for section laborers' quarters is that the necessity for maintenance is almost eliminated. This fact deserves particular consideration because much of the labor is foreign and is unmindful of sanitary requirements in the home and is naturally, even if unintentionally, destructive of the quarters in which he lives.



The Annual Banquet on Wednesday Evening

THE thirty-fifth annual convention of the Roadmasters' and Maintenance of Way Association was held at the Auditorium Hotel, Chicago, on September 18 to 20, inclusive. Although considerable doubt had been expressed regarding the advisability of holding the meeting this year because it was feared that many members would be unable to be present, the attendance compared very favorably with that of preceding years. Over 150 roadmasters registered and were in the convention hall at the opening session on Tuesday morning.

The entire convention was characterized by enthusiastic interest in the discussions. All entertainment for the members was eliminated this year and their attention was centered in the convention itself. The program was prepared with special reference to the problems now confronting trackmen. As a result the committee reports and the papers received unusual attention and were discussed by a large number of the members.

The officers of the association during the past year were: President, M. Burke, roadmaster, Chicago, Milwaukee & St. Paul, Chicago; first vice-president, A. Grills, general roadmaster, Grand Trunk, St. Thomas, Ont.; second vice-president, J. B. Oatman, roadmaster, Buffalo, Rochester & Pittsburgh, Du Bois, Pa.; secretary, P. J. McAndrews, roadmaster, Chicago & North-Western, Sterling, Ill.; treasurer, W. H. Kofmehl, Elgin, Ill.

OPENING BUSINESS

The convention was called to order at 9:30 Tuesday morning by President Burke. In order to conserve time for the discussion of committee reports and papers, the customary addresses of welcome and greetings from former presidents were dispensed with.

In his opening statement President Burke said in

part, "we are meeting at a time when the maintenance of the railroads of the country is beset with difficulties. So great is the disarrangement of the ordinary work of the various railroad departments that many of the national associations representing these departments have postponed their regular conventions this year. The question of like action on the part of our association was strongly urged upon our executive committee some months ago, but after careful consideration it was thought that the loss to the association, in an educational way, through omitting an annual meeting at this time would be too great to warrant such action, even if some handicaps would be presented.

"The problem that roadmasters are now facing is to maintain track under extremely heavy traffic, and with the least labor that has been known in the history of railroads. The shortage in track labor has been growing from year to year, even before the beginning of the present war, but the situation in which we now find ourselves in this respect surpasses even our gravest fears of previous years. It is now no uncommon experience to find many sections on which no regular force is to be found except possibly a foreman or a track walker, making it necessary to do tie renewing and other indispensable work with extra gangs. It is no secret that a large mileage of track throughout the country must, in the nature of things, be in rough riding surface when winter comes on.

"Not only is there a shortage of labor, but there is a marked shortage of material as well. It is, therefore, no time for the Roadmasters' Association to think of deferring the discussion of important questions pertaining to our work; the situation is such as to render conference on and discussion of our work more important than ever before. In the whole transportation field there are no officials working under greater pressure, or at a

greater disadvantage to maintain our railroads in serviceable condition, than the roadmasters."

R. H. AISHTON SPEAKS.

R. H. Aishton, president, Chicago & North Western, and chairman, Central Department, Railroads' War Board, addressed the convention on the problems which are now confronting the railways as a result of the war. After describing briefly the manner in which the roads transported troops and supplies to the Mexican border last year, he told of the meeting of a large number of railway executives in Washington only five days after the declaration of war at which the present consolidation of the railways of the country into one system was effected and plans developed by which the roads would be able to co-operate most effectively in the winning of the war. He told of the unusual performance of the roads in practically eliminating the car shortage while at the same time handling the heaviest traffic in their history.

Mr. Aishton predicted that railway men in this country will soon be confronted with conditions more serious than those which now prevail. He stated that past precedents are now worthless and that each problem has to be solved on the basis of present-day conditions. The roads are doing things in many departments which would have been thought impossible a few months ago. He emphasized the necessity for individuals and corporations to subordinate their interests to the primary purpose of winning the war and stated that 822 employees of the Chicago & North Western had volunteered for military and naval service before the selective draft became effective, while over 15,000 additional employees on this one road were subject to the provisions of this act, creating a special problem in itself.

SECURING AND RETAINING TRACK LABORERS

It goes without saying that the first and best method of securing laborers to work on tracks is to offer them inducements equal or superior to those tendered by other companies or individuals employing similar help, while to retain them once we do secure them, we must accord them privileges and permanent employment consistent with the best interests of the employer and employed. On sections or other locations where labor headquarters are permanent every effort should be made to encourage trackmen, either laborers or foremen, to own their own homes. A foreman should be assured of the permanency of his position by his superiors and he, in turn, should impart such knowledge to the men under him to make them feel that they have an interest, not only in their work, but in their home town. The number of men should be the same in winter as in summer. No more pernicious custom obtains than that of keeping the men in a section gang guessing during the summer months as to who will be retained and who will be laid off when the first snow begins to fly.

Section foremen should be permitted to hire their own men, and when there are laborers who cannot or will not rent or live in houses of their own, they should be provided with a bunk house at a location convenient to the work and where a certain amount of privacy is insured. This arrangement, known as a camp, should be equipped with a cooking range and other necessary fixtures. A cook of the same nationality as the men should be secured who is able to cook good, wholesome meals; have warm water for men to wash in and keep their sleeping quarters clean and comfortable. This arrangement will always tend to attract good laborers.

When a foreman cannot secure his own laborers, they should be furnished by the railroad's authorized agent, but the labor agent's connection with the men should end there. The custom of having the labor agent furnish the victuals and wearing apparel of the men should be discouraged, as this system often results in charges and deductions against the laborer's wages that the men do not know of and in many cases do not owe, causing no end of trouble on pay day. Men for extra forces or floating gangs should be hired by the foreman of the gang when possible, but if he is unable to do so, they should be furnished by an accredited agent employed by the company on a salary, to preclude, as far as possible, the practice of charging men commissions for their jobs. His sole duty should be to get men from the source of supply and deliver them to the foreman at the point needed.

Bunk shanties or cars should be provided with double-deck steel bunks, good ventilation, wash basins, water coolers and other facilities. The dining car, or dining room should be well ventilated and sanitary and the cooking cars or compartments provided with all necessary utensils and ample storage for supplies. These camps should be conducted by a boarding contractor (if possible, a man and his wife) who will know the kind of victuals desired by the particular kind of labor employed, and who will provide them with plenty of good, wholesome food, well cooked and served in a clean and sanitary way, and who will also see to the sleeping accommodations. An ample supply of bunks and bedding should always be provided by the company to take care of additional men as they arrive, avoiding the rather frequent abuse of men coming to a camp to find that there are no sleeping accommodations for them.

If Italian labor is used, the above arrangement may not apply, as these men do not care for cooked meals, preferring to handle their own food. In such cases, only good sleeping quarters are needed, with plenty of water and other sanitary arrangements, and a commissary where they can secure the necessary supplies.

To retain laborers after we do secure them is often easier said than done, and as long as other companies and individuals can offer better inducements than the railroads our men will leave us. With a perfectly clear knowledge of the cause of our shortage of men, our



M. BURKE,
PRESIDENT ROADMASTERS' ASSOCIATION

failure to take a firm stand in the matter, both in the men's behalf and our own, is to be deplored. We all know the remedy. To build and maintain tracks to carry high-speed passenger trains and a constantly increasing tonnage of freight trains with ever larger engines, we require just as good men as are demanded by other departments. The trouble is and has been that the importance of the track department is under-estimated, and no man comes to work in it who has any pride in himself or regard for those depending upon him because he will be looked down on by men in other branches of the service.

The remedy is first, in the compensation we give our laborers and the manner in which we house and feed them; and second, in the treatment we and our foremen accord them and the opportunities offered for earning promotion. We should also furnish them motor cars to carry them to and from their work. It is nothing new to the supervisor of tracks, where hand-pumped cars are used, to see men leave him for roads where motor-driven cars are used. All other mechanical tools consistent with the work should be used. All of these suggestions should be fully discussed and positive recommendations made that will carry weight. As one of our most vital questions at this time, it should not be permitted to drop until relief is secured. A. M. Clough (Chairman), supervisor New York Central, Batavia, N. Y.

DISCUSSION.

The acuteness of present-day labor conditions were emphasized by the spirited discussion which this report created relative to the employment of section forces throughout the year. T. Hickey (M. C.) advocated the employment of track forces throughout the year, stating that on his line these men could perform productive work throughout the winter. D. O'Hern (E. J. & E.) also advocated the same practice and pointed out that the gaging of track and the tightening of bolts were typical of much work which could be done at that time. P. J. McAndrews (C. & N. W.) pointed out that the lengthening of the working season for track forces reduced the number of men required to perform a given amount of work in direct proportion to the extent to which the season was extended. The present practice of concentrating track work in a few summer months creates an abnormal demand for men which subjects the roads to unfair demands from the men and in turn leads to many unfair practices and abuses. He believed that a permanent force will be applicable on 80 per cent of the railway mileage of the country. Coleman King (L. I.) described the permanent-force plan, which has been in effect on the road with which he is connected for the past three years, and told of its advantages. He said that he is able to guarantee permanent employment to men throughout the entire year and that this fact has proven very attractive to laborers. In reply to a question, he stated that over 90 per cent of the men now in service have been in the employ of the company

for over a year, in spite of the fact that there is now a greater disparity between the wages paid on the road and in outside industries than ever before. J. B. Oatman (B. R. & P.) stated that his winter force was 68 per cent of the summer force authorized to be put on in April, but that at no time this summer had he been able to increase his forces to over 75 per cent of the full allotment. In other words, while able to hold the larger

part of his winter force in the face of higher wages elsewhere, he was able to recruit very few additional men. He strongly advocated the permanent force as a material aid in the solution of the existing labor problem.

The advisability of the roads operating their own labor bureaus and boarding camps also led to extended discussion. George Beckingham (G. T.) advocated the operation of a company labor bureau, believing that the men would soon learn of this bureau and would come to



P. J. McANDREWS,
SECRETARY

it for employment in preference to outside bureaus with their fees and abuses. He also advocated the boarding of track employees by the railways rather than by contractors whose interests lay in the profit they could secure from the men. This led to a discussion of the minimum size of gangs for which a company should provide cooks. J. B. Oatman stated that it is the practice on his road to furnish cooks with gangs of 6 to 8 men and occasionally with only 4 men. James Sweeney (C. & E. I.) stated that this was also the practice on his road.

THE INSPECTION OF TIES IN TRACK FOR RENEWALS

INSTRUCTIONS FOR TIE INSPECTION AND RENEWALS.

1. To secure uniform practice and to prevent the removal of ties from track before their safe service life is exhausted and at the same time to distribute renewals properly in all tracks, ties for renewals should hereafter be marked by inspectors reporting directly to the supervising officers.

2. When the season arrives for the inspectors to start out, after conferring with their superior officers, they will inspect one mile of main track on each section in order to allow the section forces to begin tie renewals. They will then complete the inspection of all ties in main tracks and sidings on all sections. Inspectors will make a daily report to their superior officers on the proper form, showing the number of ties marked for renewals in the main track between each two mile posts and the number of cross-ties; switch ties and cross-over sets marked for renewals in each siding, giving the siding numbers.

3. Section foremen must in all cases accompany the inspector over their sections while the inspection is being made. For 1917 renewals one heavy white mark must be placed on the rail above each tie to be renewed, this mark to be placed on the west side of the west rail. Inspectors should keep a book record of all inspections, to be used from year to year for comparison.



A. GRILLS,
FIRST VICE-PRESIDENT

4. There should be two standards for marking ties for renewals: (1) Where the track is not to be disturbed and (2) where the track is to be raised off the old bed. In the latter case, ties should be inserted while the track is being raised, thus placing them on the new bed. In the former case, ties should be dug in.

5. Inspectors should be provided with inspection picks, paint brushes and the necessary white lead paint.

6. Inspectors should be furnished with a statement showing the location of all track which is to be raised on each section, also the track where new steel is to be laid and re-ballasted.

7. Every tie which apparently is not good or which shows signs of decay or failure must be inspected with the pick.

8. In determining the necessity for replacing a tie, its condition as to decay and wear, the amount and character of the traffic carried, its position in track, the kind of timber, the condition of neighboring ties, the weight of rail and tie plates must all be considered.

9. Case 1—Ties should be inspected for the condition of timber by driving the pick into each side adjacent to the rail seats, near both the bottom and the top faces, below the sap line. The pick must be driven into the ties toward the center and must be drawn with as little prying as possible. Ties should not be tested on the top, with the exception of making tests for decay around tie plates and spikes. In making these tests, the ties should not be mutilated more than absolutely necessary. To test a tie for strength, one end of the pick should be inserted under the end of the tie and the pick used as a lever. If a tie is broken under the rail seat this method will usually determine it.

9-A. If two ties of only one year's safe service are together, one must be removed, and a group of ties of only one year's safe service, must be so removed as to leave each doubtful tie with one good neighbor.

9-B. Sap rot alone is not to condemn a tie for service.

9-C. A tie cut down by rail wear is not to be removed unless the rail is cut into the face more than one inch. This applies to ties in tangents, as all ties should be full-plated and protected against rail wear on curves. On curvature where, through repeated rail renewals, ties are necessarily adzed more or less for the new plates, when a tie is so cut down as to weaken it for the service imposed, it should be removed and saved for side-track renewals if the timber is sound. On tangents where a good tie is cut down not more than one inch with rail wear or adzing, it should be protected against further cutting with tie plates.

9-D. In case ties are spaced too wide apart or where a large hewn tie is removed and replaced with a smaller tie, an extra spacer tie may be inserted, as the judgment of the inspector may decide.

9-E. Very careful attention must be given to the inspection of red oak and pin oak, also any other kind of timber that decays from the heart, as such ties usually rot from the center, leaving a hard shell, which can only be detected by careful inspection.

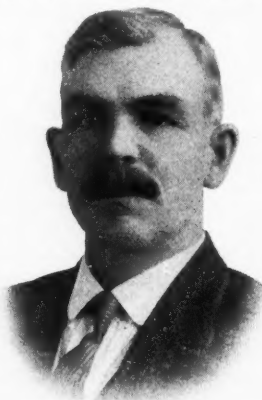
9-F. Where track is subject to heaving, and where shimming is necessary, care must be taken to insure enough good, sound timber for spiking and bracing, and careful attention must be given to the inspection of ties through road crossings, station platforms and other places where they are covered and liable to be overlooked by the section foremen.

10. Case 2—In track where new rail is to be laid or old rail is to be re-ballasted out of face, sufficient renewals should be made to last at least three years, depending upon the conditions, without being disturbed for

renewals during that time. Inspectors will make a liberal inspection of such tracks, testing the ties for decay, as in Case 1, but removing all ties that will not last more than three years. Where new steel is laid, no bad ties must be left under the joints. In making renewals in this case, some fairly good ties may be taken out, in which case they should be sorted and piled carefully, to be picked up and distributed for side-track renewals.

11. A lower standard of inspection should be used for mine lines and side tracks, especially for standing tracks in yards, where no tie must be taken out of track until its safe service life is exhausted.

12. In passing tracks care must be used to see that ties around turnout curves are in good condition.



W. H. KOFMEHL,
TREASURER

13. In main tracks and sidings where the track is not to be lifted, foremen must renew only the ties that are spotted by the inspector, and in case they find ties which, in their judgment, should be renewed, they will notify their superior officer and the inspector will be sent back to make a re-inspection. Where track is to be raised, the foremen should renew ties marked by the inspector and remove any unmarked ties which in their judgment should come out, such ties to be marked with a cross on the face and laid aside

for examination by the inspectors.

14. Inspection of ties by an independent inspector should not relieve the roadmasters, supervisors or foremen of the responsibility for the safety of the track in their charge.

15. Inspectors will inspect all switch ties in accordance with the above, except that in case a switch or cross-over set is more than one-half decayed, requiring renewals, a new set should be put in and any old ties taken out which are fit for use are to be saved and used for patching other sets.

16. After all tracks have been gone over and inspected, inspectors should spend their time checking renewals and marking ties which were missed by the first inspection. They should also carefully examine all ties taken out by foremen which were not marked originally and should see that all usable ties taken out of the track from any cause whatever are properly sorted and re-distributed for side-track renewals. Inspectors should give careful attention to all features of track work as they go over the line, especially in connection with tie renewals, and report promptly to their superior officer any defective practice coming to their attention, such as striking picks and other tools into new ties when drawing them into track, also adzing, spiking, tie-plating, etc.

TREATED TIES.

The following is submitted for information only:

As a large number of the railroads have been using treated cross-ties for some years past, all trackmen should give careful attention to these ties which show signs of failure.

INDICATIONS OF DECAY.

Treated ties which have begun to decay below the depth of penetration usually show certain characteristic

indications, the most frequent of which are (1) a pronounced checking of the surface, frequently accompanied by a curling of the wood along the check; (2) numerous fine checks extending over the whole or a part of tie; (3) a discoloration of the surface of the tie, usually consisting of a lighter color immediately adjacent to the check and a much darker color beyond this light streak, the extent depending upon the amount of decay. A light or dark discoloration may also occur by itself, without the accompanying checking of the tie, which sometimes indicates decay.

These indications may occur either separately or in combination. In some few instances ties have decayed spots below the depth of penetration without showing any visible indication, and these can only be discovered by sounding the tie, a hollow sound indicating that decay is in progress.

RECOMMENDED INSTRUCTIONS TO BE GIVEN TO TIE INSPECTORS.

Tie inspectors should be required to examine each treated tie in track; this examination to consist of a careful inspection of the appearance, sounding with a light metallic blow; in all cases where the tie is checked, a suitable narrow, flexible steel blade should be inserted carefully to determine the extent of the decay, if any. The same rules which apply to untreated ties should govern the spotting of treated ties, but it must be borne in mind that it is very probable that for the next few years, at least, practically all of the treated ties will run several years longer, so that they should not be marked on the same generous basis as the untreated ties when inspecting for track to be raised out of face. Under no circumstances is the pointed end of the inspector's pick, used on untreated ties, to be used on those which have been treated; the treated portion of the tie must not be penetrated except by inserting the blade into the check already existing. Care must also be taken to avoid bruising or chipping the surface of the tie, and in general the inspectors must realize that the integrity of the treated tie is entirely dependent upon maintaining the treated surface intact. Inspectors should show full information on their reports as to the kind of timber, the date put in track and the character of defects of all treated ties spotted for renewals.

SUGGESTIONS AS TO THE BEST METHOD OF SECURING COMPETENT TIE INSPECTORS.

The best results will be secured by assigning one or more of the most competent foremen on the division to act as tie inspectors, selecting foremen who have had considerable experience with different kinds of timber and who have shown ability to judge ties which should and which should not be removed from the tracks. They must also be competent to make out intelligent reports and to get along with the different foremen with whom they come in contact during the season. J. B. Oatman (Chairman), roadmaster, Buffalo, Rochester & Pittsburgh, Du Bois, Pa.

DISCUSSION.

D. O'Hern (E. J. & E.) said that it was his opinion that no further inspection was required than that made by the foreman, assisted by the roadmaster or supervisor. He cited a case of the incompetency of the class of men frequently employed as inspectors. Neil McNabb (M. C.) expressed a similar view. J. B. Oatman replied to these objections, saying that the track officers on his road were glad to have the tie inspectors employed, because it saved them a lot of time. As the inspectors

devote their entire time to the work, they can select the ties for renewal much better than a supervisor or roadmaster, who cannot take the necessary time, and while old and experienced foremen as a rule are competent to judge the ties, it is a fact that there are a great many young foremen who are incompetent. H. Van Gorder (C. & N. W.) said that he believed most of the members would be glad to have tie inspectors if the inspector reported to the roadmaster rather than the roadmaster to the inspector. He agreed with Mr. Oatman that some of the foremen were incompetent.

T. F. Donahoe (B. & O.) stated it was his experience that roadmasters were glad to have the inspection of the ties taken out of their hands because of the amount of time required. He objected to the plan to inspect one mile of each section at a time, on account of the time lost in riding to the next section. The inspector could put in his time to greater advantage if he covered a greater continuous stretch of track at a time. J. B. Kelley (M. St. P. & S. S. M.) favored tie inspectors, as he believed that a large amount of waste resulted in some cases from the usual practice of having the foremen select the ties to come out.

C. H. Gruver (C. R. I. & P.) outlined the practice of the Rock Island to select two roadmasters each year to make a check inspection of the ties to be taken out on the districts of other roadmasters. One objection to this system was that roadmasters engaged in this work who came from one part of the country were not sufficiently familiar with the conditions in other parts to be competent to pass on the ties to come out. For instance, a roadmaster from Oklahoma would not appreciate conditions in Minnesota, where many ties are broken every winter on account of frost.

F. J. Meyer (N. Y. O. & W.), who was a member of the committee, said that it was the committee's idea in drawing up the specifications that the inspector would relieve the roadmaster in a large measure so that he could devote his time more profitably to other work. He believed that the saving in ties would fully justify the employment of an inspector. Many new foremen, particularly where they are foreigners, are not competent to determine the ties to be removed. These men as a rule judge their work by what they do, as, for instance, the number of ties they take out, rather than the results in line and surface. If not watched carefully they will renew the ties where they can be put in the easiest or where the least amount of trucking will be required. He said that he always checks up his foremen himself on this matter, and in making a comparison with other roadmasters who left it entirely to the foremen he found that the renewals on his district were materially less. P. J. McAndrews (C. & N. W.) said he believed that a roadmaster or supervisor who had a large district cannot possibly inspect all of the ties himself and that the saving in ties was sufficiently important to employ an inspector. By saving four or five ties a day the inspector would earn his own salary.

TUESDAY EVENING SESSION

At the session of Tuesday evening, there was an open discussion of the best forms of construction of highway and street crossings. P. J. McAndrews (C. & N. W.) described the rapidly increasing agitation for the better maintenance of crossings in the smaller towns and on the more important country roads, as well as in the larger cities, and urged that the roadmasters pay more attention to this subject. P. M. Dinan (L. V.) described the practice of the Lehigh Valley in replacing all plank

crossings with macadam. This practice has been followed for three years and consists of the installation of coarse stone covered with screenings, on which a surfacing of asphalt or oil is applied. It has been found that these crossings are more satisfactory to the public and less expensive to maintain than plank crossings. M. Griffin (C. R. R. of N. J.) described the experience of the Central Railroad of New Jersey with various kinds of crossings. Plank crossings were used originally, but they heaved badly in the winter time, tearing off locomotive pilots occasionally and being dangerous as well as expensive to maintain. The center planks between the rails were then removed, leaving only one plank on each side of each rail, but while this was an improvement, it was also unsatisfactory.

More recently the planks have been eliminated entirely. The earth is now excavated to the bottom of the ties under the track and from 8 to 10 in. deeper between the tracks. A 6-in. drain tile is inserted between the tracks and the crossings are then filled with stone ballast and finished off with screenings, which are oiled. The wheels are allowed to cut their own flangeway, this having been found more satisfactory than the use of rails laid on their sides. Where the track is laid on a grade a catch basin is placed at the upper end of the tie. The crossings are oiled three times a season and have been found to give satisfaction. F. J. Meyer (N. Y. O. & W.) described seven macadam crossings which he built over one year ago which have caused no expense for maintenance since that time. He found the road commissioners willing to co-operate in the construction of these crossings, as they were as anxious as the railroad to secure good crossings.

G. S. Eaton of the Universal Portland Cement Company, Chicago, described experiments which that company is now making with pre-cast concrete slabs for highway crossings. C. F. Ames of the Barrett Company, New York, also described the development of tarvia for crossings and gave figures showing the cost.

TRACK WORK AT CANTONMENTS.

Coleman King, supervisor of the Long Island, Jamaica, N. Y., read a paper at the Tuesday evening session describing the construction of the tracks at the cantonment on Long Island. He related in detail the problems involved in the collection of the materials and the organization of the forces for this work in the limited time available. Owing to lack of space the publication of this paper will be deferred until a later issue.

THE MATERIAL PROBLEM

By W. A. SUMMERHAYS

Assistant Purchasing Agent, Illinois Central, Chicago, Ill.

It has been stated that, because of this war, more than 30,000,000 men have left their ordinary vocations to take part in the fighting or in supplying their brothers on the firing line; they have left the arts of production to engage in the arts of destruction. Imagine the tremendous industrial gap which the United States is called upon to fill! With millions of tons of our produce going to the foreign fields and with our own government's tremendously increased requirements, the mills and factories are burdened with the heaviest business in their history. This they are handling with labor daily becoming more scarce and raw materials more difficult to procure. The materials thus produced apply on orders taking precedence over those booked for domestic uses many months previously, and the resulting condition is a demand for iron and steel that has sent

the prices skyward, while deliveries date from 6 to 18 months after placing orders.

Under these conditions the railroads are finding great difficulty, not only in maintaining their customary stocks of material, but in obtaining enough of the most necessary items to keep the road and equipment in safe operating condition. While deliveries have been greatly delayed, prices have steadily climbed. Track spikes that could be bought for \$3 a keg two years ago are now selling at \$8 a keg. During the same period track bolts have advanced from \$3.75 to \$11 a keg, angle bars from \$1.50 to \$3.25 a hundred weight, tie plates from \$36 to \$65 a ton, rail anchors from 16 cents to 31 cents each, steel rails from \$30 to \$40 a ton and other items proportionately. A very conservative estimate of the increases in prices of all items of material used in maintenance of way and structures places the figure at 30 per cent.

Just as it has become necessary for the nation to register its available men and its manufacturing facilities, so must the railroads know exactly what material and men they have available at all times. We have in our store departments complete records of each item of material in stock at the storehouses in addition to the quantities which are due on unfilled orders. On most railroads, however, it is the practice to carry small emergency stocks of track materials at designated points along the line as well as regular working stocks at each section foreman's toolhouse. It is a quite general practice to charge such material to operating or other accounts as distributed from division or general storehouse, although a few railroads, realizing the amount of money involved in such stocks and the necessity of knowing at all times the actual assets in available material, have refrained from this practice and instead make no charge against the accounts for such material until it is actually reported used in the foremen's monthly material reports. In these times it becomes very necessary for each roadmaster and storekeeper to know exactly what is available at every point on the railroad. This is best accomplished by having for each division, whether in the office of division storekeeper or roadmaster, a complete tabulated list of every item of material on the division, showing its exact location. This statement should be kept up to date by adding thereto each shipment of material received from the storehouse or supply car and deducting therefrom each item of material reported as used by the foremen. When emergencies arise requiring the immediate use of materials which can not be obtained readily through the customary sources, a record of this sort, showing the material on hand on the line of road is invaluable. The amount involved is no small matter, amounting to \$10,000 or more on any average operating division, and to \$20,000 or \$25,000 on the larger, busier railroads where rail, cross-tie and tie plate renewals are more frequent. It is well worth the time of a man with a motor car to go over the line frequently to check the stocks and verify the records.

It is a natural tendency in maintaining line stocks of material to keep on hand more than the working conditions on the division justify. A record such as above described will show at a glance just how long each item has been on hand and whether it should be transferred to some other point where needed. Every transfer thus made saves the purchase of new material and tends to conserve the resources of the country which are so badly overtaxed at present. No requisition should be passed to the purchasing agent until it has been carefully checked against the record of line stock as well as

of storehouse stock and an effort made to supply the items needed from stock on hand.

Much of the material carried in line stock as a safeguard against possible emergencies remains on hand a long time before it is used. Unless given an occasional coating of heavy oil or thin paint the material soon becomes damaged by rust or action of the elements until it is little better than second-hand material. Such material stock should always be kept in first-class condition, and while the prices are so extremely high there is much greater necessity of watching this feature and protecting the material from exposure.

It is extremely important to watch constantly the uses to which materials are put. Every dollar wasted in material means the expenditure of \$1.50 or \$2 to purchase the same quantity in replacement and nothing should be discarded until it is actually worn out. Employees must be instructed over and over again to watch every day the use of material, making the articles already in service last still longer where this is possible to be done.

While the prices of new material have advanced 30 per cent to 200 per cent, the price of scrap has risen to an even greater extent, and this has given rise on many railroads to a campaign toward cleaning up all scrap and putting it on the market. While it is desirable at all times to market all scrap as soon as it is available without permitting any accumulations, great care must be exercised to avoid selling as scrap a single item which can be put to further use. Even though the price of scrap is 300 or 400 per cent higher than at the start of the war, we must remember that the spread between scrap material and new material is much greater now than at that time. In other words, a ton of scrap track spikes sold in 1914 at \$9 could be replaced with a ton of new track spikes for \$30. The same transaction to-day would entail a difference between scrap and new of \$45 instead of \$21, and similar differences apply to all other iron and steel items.

Although all section foremen may be fully instructed relative to carefully inspecting scrap before loading for the market and holding out every usable article, it is a very human tendency to discard with the scrap all second-hand material of which the foreman has no immediate need. It, therefore, becomes necessary either to place with every scrap train a competent inspector who will pass upon all scrap which is being loaded and set aside and unload at the proper place on the division all material which is fit for further use or can be reworked, or where it is not feasible to have such a man accompany the scrap car, it is a very good policy to have the car set out at some point, preferably the general scrap yard, and have the contents carefully assorted and inspected. In this manner a great many rails can be saved and used in side tracks and yards or shipped to frog works and used in the making of guard rails. Track spikes can be straightened, repointed if necessary, and issued for further use in side tracks and yards. Track bolts can be oiled, fitted with nuts and reissued for use. Rail anchors can be matched up, a jaw closed by a blow from a hammer if spread, and the anchor made equal to a new one. Tie plates, if buckled but not too badly corroded, can be straightened and used in side tracks or other suitable places. Railroad crossings can be cut apart and certain parts, such as fillers, knees and bottom plates, held for use with new crossings ordered for the same location. There is no item or material more difficult to obtain in the present iron and steel market than rolled steel plates, and any action taken toward conserving the plates taken out

with worn-out crossings and applying them under the new crossings ordered for the same point would be of decided benefit to the manufacturers engaged in furnishing plates for the Government.

Where facilities are provided for reworking and assorting scrap at one point on a division or railroad system, a very decided saving can be effected by employing a blacksmith to rework certain materials. At very nominal cost a forge, anvil and set of blacksmith tools may be installed and if electric or steam power is available a small grinding wheel and drill press can be added. With this equipment one man with a helper can keep in repair all of the track tools, track drills and track jacks for an entire division and in addition can take from the scrap which is accumulated, the switch stand connecting rods, switch bridle rods and similar items, repairing them for further use. Where the bolt holes are worn they can be plugged and redrilled; the bridle rod lugs heated and straightened and the switch stand connecting rods upset on an anvil and the hole reamed out to proper dimensions. An outfit as above described would cost less than \$300 exclusive of buildings, and would make a net saving of \$150 to \$200 every month that it is in operation. With a small addition of wood-working tools and painting equipment all hand cars on the division could be shipped to the same point and kept in constant repair. It can easily be imagined how a shop of this kind could readily expand and take in all motor car repair work and on at least one railroad system the typewriter repairs for the entire system have been added to the work of the reclaiming department.

All roadmasters are familiar with conditions in the rolling mills, due to giving preference to the government's requirements for new rail, the result being a decided shortage in new rails on many railroads. This condition has strongly affected the supply of frogs, switches and guard rails owing to inability of the frog manufacturers to procure new rail. Every roadmaster can help this situation by making careful inspection of every piece of track material removed from track. Many spring frogs and bolted rigid frogs can be made fit for further use, when removed from track because of having only one part broken, by removing a similar part from another scrap frog and making repairs. A great deal of this kind of work is being accomplished on various railroads, some railroads going to the expense of fitting up small shops where second-hand rail can be planed and fitted to supply the needed parts in repairing frogs. Where a planer is installed for this purpose worn-out switch points can be cut off and planed to a shorter length for yard use. Short pieces of rail can be reclaimed from scrap and used in manufacturing guard rails. The Chicago, Milwaukee & St. Paul, the Delaware, Lackawanna & Western, and a few other railroads have gone into this feature of reclaiming to the extent of completely equipping frog and switch manufacturing plants where their entire requirements for frogs, switches and railroad crossings of rail construction are manufactured, new rail being employed only for material to be used where new rail is being laid. The cost records maintained at these plants show a handsome annual saving when comparing the cost of the plant output with the new value of similar items. In view of the wide spread between the cost of new material and the value of scrap material, the present is an exceptionally favorable time for installing a plant of this nature.

The great difference between prices of scrap and new materials have called the attention of railroad executives to the ease with which certain classes of scrap

iron can be rolled into merchant bar iron and several railroads have installed quite elaborate rolling mill plants for reworking the scrap which they accumulate. A plant of this kind would be especially valuable at this time, when, with the addition of a heading machine, the bar iron as received from the rolls could be cut into length and manufactured into track spikes and track bolts. Some railroads are meeting their entire requirements for track spikes and track bolts at their own rolling mills.

DISCUSSION.

William Shea (C. M. & St. P.) explained the process used on his road to collect scrap by operating a scrap car on the local freight once a month in addition to a general clean-up train once a year. Small scrap is loaded in open-top cars so that it is easily removed at the yard with a magnet, while frog and switch scrap is loaded in separate cars. He emphasized the importance of sorting scrap, stating that some railroads were losing money at the present time because the shortage of labor prevented them from doing this. In consequence the scrap was sold at lower rates than could be secured with proper classification.

Thomas Thompson (A. T. & S. F.) described the methods used at the Corwith scrap plant of the Santa Fe in handling scrap. On this road the sorting is all done at the central plant. An important matter for the roadmaster to watch is to see that the foremen are thoroughly interested in the work.

P. J. McAndrews (C. & N. W.) described in detail the methods used on his road in reclaiming worn frogs on side tracks and in yards by welding with a torch of the oxygen-acetylene type. The North Western now has 50 of these welding outfits and plans to provide each roadmaster with at least one of them. He said the process has not yet been used on main tracks, but that he believed it would be practicable. He had repaired a main-track crossing at a cost of \$25 which it would have been necessary to replace with a new one within sixty days if the repairs had not been made. On ladder tracks in yards it is not economical to do the work in place owing to the interruptions caused by switching movements. For such work a spare frog is supplied and each frog is taken out in turn. The cutting of rails has also been done successfully. For main-track standards it is necessary to use a device to hold the torch perfectly steady to get a square cut, but for side-track work, a man can do the work sufficiently well with little trouble. In this class of work in one case 9 cuts were made in 100-lb. rails and 18 holes were drilled for bolts at a cost of \$3.40 for the material and labor. In his opinion, holes can be made in this manner with sufficient accuracy. The torch has also been used to cut off bolts when renewing angle bars.

The company furnishing the torches supplies an instructor to teach the application of the process, and it has been his practice to select bright section laborers to be trained for this work. Two men are required, one to do the work and the other to serve as a lookout for trains.

THE ECONOMY OF OILING TRACK FASTENINGS

By E. T. HOWSON,

Editor, The Railway Maintenance Engineer.

To have suggested that track fastenings should be oiled to protect them from corrosion would have subjected one to much ridicule only a few years ago. Yet to-day not one, but several large roads have made this a standard practice and others are awakening rapidly to the economy

of this procedure, so that it is now a subject of live interest to trackmen.

THE DESTRUCTIVE EFFECTS OF CORROSION.

The destructive agents attacking track materials may be divided into two general groups, (1) those resulting from wear created by service and (2) those resulting from atmospheric and other agencies producing corrosion. It is with the latter group that we are interested here. Corrosion is induced primarily by (1) the action of the atmosphere, (2) the action of salt water or spray on lines located along the seacoast, (3) by local conditions at tunnels, etc., and (4) by brine drippings from refrigerator cars.

Atmospheric corrosion is present everywhere, although in widely varying degree of activity. Its effects are most pronounced in humid climates, as in certain parts of the south, while its action is almost negligible in parts of the arid west. Thus on certain lines of the Denver & Rio Grande it is found that the nuts do not rust on track bolts, that tie plates show little if any evidence of corrosion, and that steel bridges do not require painting at intervals of less than 20 years, and that little evidence of corrosion is evidenced even then.

The action of sea water or spray is limited naturally to those lines located very close to the coast, although this action is severe at those points because of the added effect of the salt in the water. Curiously enough those roads encountering this condition have given almost no attention to the oiling of their track materials.

Another severe, although purely local condition, is that encountered in tunnels, etc., where water, frequently impregnated with acids, drops from the roof onto the track. Even where acids are not present in the water as it leaves the ground, they become charged through contact with the locomotive exhaust gases. Solely to counteract severe conditions of this character, the Northern Pacific



A PILE OF TIE PLATES REMOVED FROM TRACK BECAUSE OF CORROSION

is now applying oil to the rails and fastenings in the tracks through its Cascade tunnel.

The most severe corrosion exists on those lines over which large numbers of refrigerator cars are hauled. To secure the low temperatures necessary for the transportation of fresh meats, it is necessary that salt be added to the ice in the bunkers and this salt drains from the cars with the water from the melting ice. This brine attacks the track fastenings, bridge floors, metal cattle guards and any other steel with which it comes in con-

tact. The logical way to eliminate this trouble would be to attach tanks to the cars in which this water could be collected and the tanks be emptied at the terminals. The railway mechanical associations have undertaken to accomplish this by the promulgation of rules from time to time, but the wide division of responsibility between the roads, complicated by the fact that many of the refrigerator cars are owned by private car companies, has so far prevented any material relief being realized. It is possible that continued agitation of this subject may bring



JOINTS REMOVED AFTER 10 YEARS' SERVICE BECAUSE OF CORROSION

about this simple but important reform, but for the present the maintenance of way department is confronted with the necessity of counteracting the effect of this brine.

The first effect of corrosion is a loss of material. This may be so small relative to the total area of the section as to be negligible, but with track fastenings this deterioration frequently continues to the extent that failure is brought about from weakness due to loss of section. One of the most severe examples of brine corrosion in this country is found on the tracks of the Chicago Junction railway in the Union Stock Yards, Chicago. On one of the main switching leads over which refrigerator cars are moving almost constantly the base of the rails, the tie plates and the fastenings are eaten away so quickly that they have to be renewed at intervals of not to exceed one year.

This condition is more severe than that found on the average road. However, severe conditions are found frequently on lines out in the open. On the Brookfield division of the Chicago, Burlington & Quincy, which extends east from Kansas City and St. Joseph, Mo., to Quincy, Ill., it is necessary to replace the spikes two or three times during the life of the rail because of the corrosion resulting from the relatively heavy movement of meat products east. On this same line the tie plates are so badly corroded that it is the practice to replace all of the old plates with new ones when relaying rail. These severe conditions are brought about primarily by the brine, but the atmospheric corrosion tends to the same result.

Another common and serious result of corrosion is the rusting of the nuts in place on track bolts. This condition prevents their being tightened readily, as they should be from time to time, and causes a heavy breakage and consequent loss of bolts when they are tightened. The fact that they become rusted also causes the trackmen to

delay the tightening necessary to take up the wear in the joints, with the consequent tendency toward loose bolts, which leads to the battering and deterioration of the rail. When relaying rail, the presence of corroded bolts not only slows down operations through the necessity of cutting them off, but this operation in itself is expensive. Even more important is the loss of material which ensues through the destruction of the bolts as well as the nuts.

APPLYING OIL ARRESTS CORROSION.

The realization of the losses in track materials brought about by corrosion has led to the experimental application of oil on a number of roads during the last few years. To be effective in arresting corrosion, it is important that the proper grade of oil be selected. It must not be so thin that it will not remain on the fastenings, but will run off freely onto the ties and ballast, while it should not be so thick that it will not distribute itself over the metal readily. The oil must also be able to withstand the action of the weather to a reasonable extent. Best results will be secured by applying it during dry weather, so that the dust raised by traffic will adhere to it and form a protective coating over the metal. Where the proper grade of oil is secured it has been found possible to retain this coating on the fastenings for a year or more.

When experimenting in a limited way it has been the common practice to apply the oil by hand, giving a track walker or section man a bucket of oil and a small broom, brush or swab. This was the method used by the Chicago & Northwestern in oiling the joints on six miles of track in which new rail was being laid last year. Ordinarily crude oil was used for this work at a cost of about \$4 per single-track mile, 50 cents of which was for material and \$3.50 for labor.

The Chicago Great Western applied a cheap grade of oil, commonly known as "slops," to the fastening on 20 miles of track on each supervisor's territory last year, limiting the application to those points where new Weber joints were being applied. This experiment was made to determine the extent to which corrosion of the metal would be arrested and also the extent to which the wood filler blocks would be protected from decay.

The Union Pacific oiled the joints in one mile of track in each roadmaster's district on the Wyoming district last fall. After trying different methods it was decided that best results were secured by spreading the oil underneath the ball of the rail and on top of the continuous joints with a small, flat paint brush. Oil was also applied to the top of the nuts and nut locks on the bolts. In this way opportunity was given the oil to work downward along the inside surface. The bolts were not tightened for two or three days after the oil had been applied, but after that interval it was found that they were tightened more easily and that the threads on the bolts and nuts were maintained in better condition, thereby securing a saving in both labor and material. To secure a direct comparison of results a number of joints which had been oiled and a similar number which had not been so treated were removed recently for examination, and it was found that while the bolts which had not been oiled showed evidence of corrosion and cutting of the threads, the others showed no such tendency.

It has been the practice on the Cincinnati, New Orleans & Texas Pacific and the Alabama Great Southern for two or three years to oil the joints thoroughly when laying new rail. It has also been the practice to oil the nuts on track bolts in the track at intervals, using a swab or brush and ordinary black oil or the lower grades of fuel oil. While no accurate records of the cost of

this work have been kept, it has been found that the breakage of track bolts when tightening them has been very greatly reduced.

The Chicago, Burlington & Quincy adopted the practice a year ago of oiling all the joints and bolts when laying new rail or when relaying second-hand 85-lb. rail or heavier on main lines. Bolts in main tracks which are to be relaid are also oiled about a month in advance of the removal of the rail and this practice has been found to permit a much larger percentage of the bolts to be reclaimed. Recent studies of this subject have also led to the decision to oil not only the joints, but also the base of the rail and other fastenings on certain lines of this road.

A little over two years ago the Illinois Central began to experiment with the oiling of track fastening on its Southern lines, the results of which have been so satisfactory that it has been extended over the entire system and all joints are now oiled twice a year. The oil is ordinarily applied by hand with an ordinary whitewash or paint brush, although a small car has been developed by the roadmaster on the Louisiana division for local use in the terminals at New Orleans. Approximately 10 gal. of low-grade fuel oil is required per mile. The total cost of this application varies from \$2.50 to \$4.25 per mile, averaging somewhat over \$3. While this practice has not been followed on this road a sufficient length of time to enable the total saving to be ascertained, the immediate benefits are sufficient to offset the expense, while it has also been possible to maintain tighter joints and to keep them in better riding condition.

One of the earliest roads to undertake the oiling of track fastenings was the Atchison, Topeka & Santa Fe, on which road it has been found that this practice has increased the life of the bolts 25 per cent. Careful records have also shown a saving of over 30 per cent in the number of bolts required for replacement purposes on the Eastern lines, while it has been estimated that the amount of labor required to tighten loose bolts has been reduced at least 40 per cent. The oil has also been found to preserve the wood filler blocks in Weber joints and to prevent the wood from swelling and shrinking to some extent.

In oiling fastenings a pump is placed on one end of a motor-driven car. On the other end a barrel of oil is placed, with a rubber hose between the barrel and the pump. A section of 1-in. gas pipe extends from the pump alongside the rail, spraying the oil under the ball on the outside only. When applied in this way about 75 gal. of fuel oil, costing about 5 cents per gallon, is required, making a total cost for material of \$3.75 per mile and \$2.50 for labor. Where the bolts and joints are oiled alone the total cost is approximately \$2.50 per single-track mile.

THE LACKAWANNA HAS DEVELOPED AN OILING MACHINE.

The Delaware, Lackawanna & Western has developed this practice further than any other road. This line has been a pioneer in the development of heavy track construction. Creosoted ties and screw spikes are used exclusively, while the tie plates are of a heavier section than commonly employed elsewhere. With treated ties costing \$1.30 each, tie plates between 30 cents and 50 cents, screw spikes 5 cents and track bolts from 5 to 11 cents each, and other track materials correspondingly expensive, this road began an investigation of means of protecting these materials early, which led to the oiling of track fastenings. Further study led to the development of a track-spraying device in 1914. The following year

a flat car was equipped to distribute the oil over the rail and fastenings in the track, but the operator was unprotected from the weather, and it was also difficult to change the nozzle openings to correspond with the speed of the train, with the result that the work proceeded slowly.

In 1916, an enclosed air-operated car was built in a remodeled caboose. One end was rebuilt to bring the operating table as far forward as possible and the car was equipped with air compressors, air supply tanks, sand boxes, rail wiper, oil strainer, air-operated oiling devices, an automatic device for clearing obstructions on the track and adjustable circular nozzles. The car was also equipped with a headlight, whistle, air brakes, speedometer and pressure gages, enabling the operator to control the train and to know the conditions under which he was working at all times.

This car, which cost complete about \$1,000, can be connected with one or more tanks as desired, 12 tank cars being connected on a recent trip. The oil is heated to 150 degs. by heaters placed in the tank cars, utilizing steam heat from the locomotive. An air pressure of from 20 to 30 lb. is applied to the car in use through its dome. The machine is so adjusted that it oils all the rail except the head, the angle bars, bolts, tie plates, screw spikes and all fittings to a point $\frac{1}{2}$ in. outside of the tie plates and lubricates the portion of the tie that is mechanically affected in service in addition to the metal fastenings. A 60-lb. working pressure is maintained on the nozzle.

Best results are obtained when oiling at a speed of 20 to 35 miles, although the machine can be adjusted instantaneously to varying speeds to spread 100 gal. of oil per mile. Further adjustment can be made to apply light or heavy applications of the oil, as desired. After testing different grades of oil for a number of years what is known as Texas Road Oil No. 45, containing crude oil and about 45 per cent asphalt, has been found most satisfactory.

Approximately 1,100 miles of track was oiled with this machine in the fall of 1916 at a cost of \$5.60 per mile, divided as follows:

10,400 gal. of oil at 5 cents.....	\$520
Engine and crew	30
Operator	5
Materials and supplies	5
Total cost per day	\$560

When the oil was first applied, in 1915, it was expected that it would loosen and remove the scale and corrosion on the rails and fastenings and a heavy application was made where corrosion from brine drippings or other causes was severe, the ordinary application being about 100 gal. per mile. The following year it was found that the oil had removed the heavy scale and exposed the solid metal where the corrosion had been severe and at other places subjected to ordinary attacks the oil was in first-class condition on the fastenings. After making a further application last year it is evident that this oil is now protecting the rails and fastenings satisfactorily. With the dust created by traffic it has formed a coat on the metal that is not affected by weather conditions. Based upon this experience, it is believed that a heavy coating of oil after the original application may be followed by lighter applications once a year where track is not subjected to excessively severe corrosion.

The practice of oiling track fastenings to protect them against corrosion has now been developed satisfactorily to demonstrate the fact that oil of the proper grade will protect the rails and fastenings from corrosion and thereby extend their life materially. This is particularly

true of the spikes and bolts, the Lehigh Valley finding that it is now possible to forward with the rail for further use at least 95 per cent of the bolts released in relaying operations. The economy of the oiling of the fastenings would appear to require no demonstration, particularly at the present time, when these materials are obtainable only with great difficulty and long delays. The expenditure per mile is so small relatively and the operation is so simple that it is certain that attention to this subject will lead to its greatly increased adoption in the very near future.

DISCUSSION.

C. J. Coon (Grand Central Terminal) said that he had examined some of the tracks on the Lackawanna after a severe winter and that the oil had accomplished all that was desired.

C. H. Gruver (C. R. I. & P.) said that his road had issued orders to oil all joints twice a year. Although the winters are very severe on his district, he finds that the oil remains on the metal very well and he believes that the money is well spent. Crude oil is applied with a pail and brush and costs \$12 per section.

Neil McNab told of experiments made with a roof oil, but C. H. Gruver said that he believed this oil would take too hard a set and did not think that it would give as good results as other forms of oil. He added that he had secured very good results by dipping all bolts and angle bars in oil before applying them to new rail.

C. H. Gruver told of the experience on the St. Paul Bridge & Terminal Railway which had been brought to his attention. Crude oil was used on track subjected to a very heavy refrigerator car traffic and the brine dripping in consequence was excessive. The results secured were highly satisfactory.

J. H. Brown (A. T. & S. F.) said that he had had 6 or 7 years of experience with the oiling of track fastenings and that, in his opinion, it practically eliminates corrosion. In a case where rail was released after the joints had been oiled for a period of seven years, it was possible to remove the bolts and use them over again when the rail was relaid on branch lines. He placed particular emphasis on the fact that the oiling makes the tightening of the bolts much easier and that he found it unnecessary to lengthen wrench handles with pieces of pipe. Another development he mentioned was the oiling of metal cattle-guards, trouble being taken to remove them so that they could be oiled underneath. This practice has greatly increased the life of these guards.

Thomas Thompson (A. T. & S. F.) called attention to the practice of using waste oil on his road where tank cars have to be cleaned. Pits are provided in which the oil drained from these cars is collected so that it can be used for oiling track fastenings. He also said it was the custom to oil emergency rails and emergency crossings so that they could be placed in service readily.

MAINTENANCE OF TRACKS IN LARGE TERMINALS

By C. J. Coon,

Engineer of Track, Grand Central Terminal, New York.

The maintenance of track in large terminals is one of the problems confronting railroads which is of growing importance. To my mind, the maintenance should be taken into consideration when the plans for terminals are made; but, unfortunately, most terminals are built in congested territory, where the excessive cost of land, and often the presence of adjacent streets, make it nec-

essary to cut down to the lowest possible amount the expenditure for right-of-way. Consequently, the utility of many terminals is sacrificed by not having the proper amount of land, or in the effort to fit a large terminal in a very small area. This lack of territory often makes it necessary to put in sharp turnouts, which add to the cost of maintenance; and, even though seldom taken into consideration, the wear on railroad equipment is excessive in these cases and greatly increases the expense of actual operation.

There is no question about the value and economy of using manganese for frogs and switch-points and also for rail where the traffic is extremely heavy, tie-plates, guard-rail clamps, anti-creepers and many other devices. The frog grinders are indispensable where manganese is used for inserts in frogs and switch-points, and the writer has found it very profitable to use them in grinding burrs from stock rails at switch-points, grinding the walls of manganese frogs, shaping up worn manganese switch-points and leveling up battered joints at the heels of switches.

The gage in terminals, where sharp turnouts are used, requires careful consideration. I do not hesitate to recommend 4 ft. 9 in. gage for terminals where turnouts are sharper than No. 10. The writer has also found it good practice in yards to grease switch-points, guard-rails, the throatway of frogs and curves above 10 deg. There are several good kinds of curve grease made which can be applied by unskilled labor. We have found that it saves a large amount of flange wear on wheels and reduces the amount of rail wear on curves.

Guard-rails are an important factor in safe and satisfactory operation. I have used successfully a guard-rail gage which hooks over the wing of the frog and also over the guard-rail. In this way one can test the gage of guard-rails without using the old-time method of measuring the distance between the running rail and the guard-rail, or setting the guard-rail from the running rail. This gage should, of course, be based on the Master Car Builders' standard distance back to back of wheels, making some allowance for wear. With a guard-rail properly placed and using two clamps (there are many good types) one will have no trouble with derailments at frog points. The factor of safety around yards will also be increased by placing a guard-rail just ahead of the switch-point on the turnout side.

After experience with anti-creepers, I have reached the conclusion that they are indispensable, and I recommend that at least 100 be used on each double slip and a sufficient number for each turnout, based, of course, on the number of the frog. With the present refinement in adjusting switch-points, they are a necessity in preventing the running of stock rails and switch-points.

The flangeway of frogs has been given consideration by this association and the engineering societies, and the consensus of opinion seems to be that flangeway of frogs should be not less than $1\frac{3}{4}$ in. and not more than 2 in., $1\frac{7}{8}$ in. being the general standard. Personally I would not care to recommend any wider flangeway, except that where extremely sharp curvature is found 2 in. may be permissible, for the life of frogs is greatly reduced by wide flangeways.

Very frequently no effort is made to reward men for their diligence in finding unsafe conditions and reporting them, or making repairs before accidents happen. It is the writer's opinion that it would be a splendid investment if, in some small way, track walkers and others responsible for maintenance could be rewarded for their diligence in finding defects either in rolling stock or in

track which might lead to serious accident. This method would encourage the men to look for trouble which so often escapes the ordinary employee, who has no incentive to discover defects. In some terminals, a differential rate of pay has been used, and men have been paid a slight increase per hour for their industrious detection of trouble, which prevents accidents. It is my opinion that this is a good investment.

The protection of men at work is an important matter. We employ one man and sometimes two with whistles to notify men of approaching trains. This is reassuring to them, and they will work with much more energy when they know that they are protected.

DISCUSSION.

This paper brought out active discussion, particularly with reference to the length of turnouts. D. O'Hern (E. J. & E.) described an investigation which he had recently conducted on derailments of large locomotives while passing through turnouts, in which he had found that the locomotives were longer than the turnouts and were the cause of much trouble. He and other members advocated increasing the length of turnouts on passing tracks and at all points where possible to lessen the difficulty now encountered in keeping the large engines on the track. The question of proper clearance for guard-rails was also discussed, a number of the members describing conditions which they had encountered and removed by giving attention to this subject.

HOUSING AND FEEDING MAINTENANCE OF WAY LABORERS

By J. S. ROBINSON,

Division Engineer, Chicago & North Western, Chicago, Ill.

Maintenance of way laborers are usually housed in box car bodies, or in ordinary wooden buildings constructed for the purpose. A few roads have constructed permanent concrete buildings which are decidedly better when permanent locations are determined upon for section crews, but the cost is prohibitive in many cases, and they are not suitable for large gangs, as they are not portable. Ordinary wooden buildings and dismantled car bodies are not suitable for extra gangs for the same reason; consequently, old box cars have come into general use for housing large extra gangs. Such cars require specially-constructed side tracks or spurs when used outside of station grounds or yards. Such track material must necessarily be moved with the outfit, requiring the use of valuable equipment. When these camping outfits are located in yards and on team tracks, they occupy considerable valuable space, which in these days must also receive consideration.

The value of the material in this class of housing amounts to considerable. It is also a very difficult matter to keep the old cars in habitable condition without incurring great expense. The cost of fitting up old box cars for camp use, reduced to a unit price, averages about 10½ cts. per cu. ft., and even then the old equipment is seldom satisfactory. The average condemned box car body contains about 1,750 cu. ft. of space, which, according to the State Utilities Commission of Illinois, will care for only about ten men for sleeping purposes.

To offset the use of this type of housing, the writer would recommend a portable collapsible building, four of which can be transported easily on a flat or gondola car, each house providing for eight men. The dimensions of such a building should be 8 ft. by 16 ft. over all, with a shed roof 7 ft. 6 in. high on one side and 8 ft. 6 in. on the other, which would give a mean height

of 8 ft. The sides, ends, floor and roof should be constructed in separate pieces for convenience in handling and transporting. The area of such a building would be somewhat over 750 cu. ft., costing about 10½ cts. per cu. ft., or approximately the same as fitting up the old box cars above mentioned.

The advantages of the portable buildings are manifold. They may be located on the right-of-way, on the banks of streams, near springs, in or near groves, or on grounds which may be leased for a small consideration. It is obvious that such advantages in location and surroundings would be a decided benefit to the laborers. There is also another great advantage in being able to disinfect these buildings when taken down by treating with a solution applied with a brush or spray.

The buildings can be dismantled and loaded on cars for about \$5 each, and unloaded and re-assembled for a like amount. They can be transported on regular way-freight trains, thus saving the time and expense of work-train service and the time consumed in tearing up and relaying temporary tracks, etc. Small groups of different nationalities and colors can be segregated in such buildings to much better advantage than could be done in the cramped space in cars on sidings or spur tracks. These buildings can be used for kitchen, dining and commissary purposes, as well as for sleeping, by arranging the furniture for the different uses.

LABOR SAVING EQUIPMENT FOR TRACK WORK

By E. J. BOLAND,

Roadmaster, Illinois Central, Freeport, Ill.

It is the intention in this paper to give an idea of the labor-saving devices in use on one of the large railroad systems of this country. There are two reasons for the installation of this large amount of the equipment mentioned below, (1) as a matter of progress, and (2) to offset the growing scarcity of all classes of labor.

Work Cars and Boarding Outfits. Each day shows more and more the labor scarcity, especially in the maintenance department, which employs a great number of common or unskilled laborers. These laborers are scattered in small gangs over a large territory which is more or less sparsely settled. The old-time home guard is passing away, which makes it necessary to import laborers of any and all nationalities, who must be properly placed. It is necessary then to provide comfortable living quarters for these laborers as an inducement for them to remain in this line of service. Work and boarding cars should be furnished in sufficient numbers and in such condition that laborers will be satisfied. This can be done by a number of methods, some of which are bunk cars with cook and kitchen cars, permanent laborers' houses and portable laborers' houses for more or less transient gangs, and last of all, tents. It is hard to estimate the saving or return which warrants this expense, but it is absolutely necessary that they be provided over the entire system to keep anything like an ordinary working force.

Ditchers. The steam ditcher is one of the greatest labor savers in operation to-day. The company now has nine ditchers of the boom type, seven of one and two of another make. The saving with the operation of each one of these machines is estimated at 10 cents per yard on 250 yd. per day over the next best method. Six months' operation per year will save about 50 per cent on the investment. If the work is heavy or if a sufficient number of machines is furnished, it is possible to work these ditchers in pairs, that is, two machines with one work train, making a further saving in expense of at least five cents per yard. In addition to operating as

ditchers, these machines can be used in loading and unloading rail, relaying rail, loading and unloading bridge timbers, loading ties, taking up abandoned tracks, transferring loads of timber, loading cinders, loading gravel ballast, excavating for scale pits, turntable pits and building foundations, excavating or building embankments for new sidings, loading heavy scrap, loading trucks and light wrecking.

Dump Cars. Air dump cars in place of flat cars in ditcher service are of great value. The old method of handling dirt loaded by ditchers was to use a train of ten or twelve steel under-frame flat cars over which the ditcher operated by its own power, backing away as the cars were loaded. After loading, a Lidgerwood with plow and cable was necessary to unload the flats. In order to protect the ballast while unloading it is also necessary to equip the cars with aprons, which makes an additional expense. The present method is to operate two 20-yd. air dump cars with each ditcher, one ahead of the machine and one behind. By this method the cars are easily loaded and can be unloaded immediately. My experience has been that a saving of four cents per cubic yard can be made, based on 125 cu. yd. per day, which figures about 22 per cent on the investment, based on six months' operation per year. This also releases the 10 or 12 steel under-frame flat cars for revenue service and the Lidgerwood for heavier work in unloading gravel ballast.

Lidgerwood Unloaders. The company now has 11 Lidgerwood unloaders, one of which was received new on August 24. These machines are used on various parts of the system in unloading gravel ballast, sand for track elevation, dirt, strippings for banking and any similar heavy work which is found necessary. A trainload of gravel from the Foreston, Ill., pit consisting of 35 Haskell & Barker cars of about 30 yd. each can be unloaded with one of these machines in about 30 minutes, provided the material is unloaded continuously. This operation would require 210 men for about two hours and one-half without this equipment. These machines, when operated six months of the year, will save at least 50 per cent on the investment.

Track Supervisors' Motor Cars. The company has provided each roadmaster and track supervisor with an inspection car, which has increased the efficiency of these officers over 100 per cent. The track can be given much closer attention than by any other method. The entire district of 100 miles can be covered in two days without trouble, enabling these men to give close attention to the work and to confer with every foreman and road department employee en route.

Section Motor Cars. There is no question about the economy of placing a motor car with every section, bridge and signal gang. Until recently the company had only a few sections so equipped with cars of company ownership. A great number of the men had realized the advantages that could be obtained from motor cars and had purchased engines themselves from various makers, which were installed on their hand cars. It was found after three or four years that we were operating almost every make of engine and instructions were issued that no more engines should be purchased by foremen to operate on the company lines. Last spring the road purchased a number of section cars and during the summer and fall of the present season an additional order was placed for a sufficient number of cars to equip all of the gangs mentioned. This order was divided between three companies. Arrangements were also made to purchase the engines from the foremen, so that the company would be the sole owner of all of the motor-car equipment on

its lines. It is estimated that one hour can be saved for each gang each day by a motor car. The men are also fresh on arriving at their work and do not dread the homeward trip at the close of the day's work.

Bridge, Building and Extra Gang Motor Cars. The additional advantage obtained in this class of work is that the gangs often travel long distances. The men are carried to their work with the greatest dispatch and are not worn out by the trip. It is not necessary to move the camp outfits nearly so often, which saves car mileage and switching. It is much easier to obtain labor and the men are much better satisfied.

Motor-Car Mowing Machines. After trying out a machine of this character for two years it was found so desirable that 13 more were purchased, one for each division on the system. These cars will mow a neat swath on each side of the track at the rate of about 30 miles per day. Each machine will save its cost every year.

Tracklaying Machines. The nine tracklaying machines which are now operated by the company have been of great service in offsetting the labor situation. They are a great relief to the men, as the machine does all of the heavy lifting. The gangs can be reduced or more rail laid than was possible with the same gang prior to operating the machine. The ordinary new rail program on this road includes between 50,000 and 60,000 tons per year and any reduction in the cost of laying this rail cuts down one of the largest items of expense.

Rail Loaders. Each division is now equipped with an approved air rail loader which can be operated with three or four men, whereas this work formerly required about 20. A saving of this kind is an absolute elimination of all of the useless work which was formerly done by hand. A modern railroad cannot afford, in the present day, to handle rail without a device of this character.

Tool Grinders. This device has come into the maintenance of way world to stay. In taking the place of the old grindstone, it relieved about the most cumbersome tool that was carried on the hand or motor car. Grinders cost from \$12 to \$25, depending on the number of attachments provided with the machine. Tools can be kept in better shape and the machine saves its first cost in one season.

Weed Burners. These are of great value in the heavy semi-tropical country, such as the Yazoo delta and the sugar cane territory near New Orleans. The growth is so rank in this territory that it is almost impossible to handle it by the ordinary hand method. These machines, when operated over a district a second time, destroy all growth for a width of 18 ft. for an entire season. The labor of operating is almost nothing, compared with hand work in the same locality.

Rail Saws. The company is now operating one portable rail saw at Clinton, Ill., and authority has been granted for an elaborate permanent sawing plant to be located at Centralia. All second-hand No. 1 rail of the 85- and 90-lb. class is sawed and re-drilled before relaying in branch-line main track. The sawing process makes infinitely better riding track and adds greatly to the life of second-hand rail. It is figured that about \$2 per ton will take care of all of the expense of handling and sawing. The riding of track has improved 100 per cent by using sawed rail, in comparison with the old method. The results accomplished have been well worth the expense.

Snow-Thawing Outfits. This device is almost a necessity in large terminals. The greatest advantage in these outfits is that it is not necessary to reload snow and ice taken from switches and interlocking plants. In con-

gested territory it was formerly necessary to cast snow out of the switches and in some cases it would have to be handled five or six times before it was finally disposed of. Snow throwers give immediate relief and do away with the re-handling. One man with one of these outfits can accomplish as much as three or four by the old method.

Cinder Cars. Each terminal should have a sufficient number of cinder cars to take care of all of the cinders handled without using cars in revenue service. Cinders are now loaded at large terminals with some approved form of clam shell, but it still remains for the section men to unload the cinders out on the line. The side dump car with the ridge bottom is the best class of car in service. It is proposed, however, to make these cars large enough to hold 50 tons of cinders, which would cut down the number of cars and greatly aid in the distribution. Ordinarily our cinder cars have been made from old condemned coal cars and were of very light capacity. It is almost impossible to estimate the amount of money lost in the maintenance department on account of using coal cars, especially during freezing weather and the rush of business when cinder cars are not available.

There are many other small devices which are of great advantage to the trackman, some of which are—

Lawn mowers,
Switch-point straighteners,
Portable electric timber drills,
Oxweld repair outfits,
Ballast screening outfits,
Rail benders,
Snow plows and flangers,
Electric trucks (for service in shipyards and docks).
Cleaners for bridge steel (no satisfactory device is on the market at the present time, but a device for cleaning bridge steel preparatory to painting would be a labor- and money-saving device).
Tie sizing and boring machines.
Acid grass and weed killers (several of these patent weed killers have been tried out on this system, but the results obtained have not been satisfactory enough for the expense incurred to justify their use). I think that every device of this kind should be given fair trial, as the labor to remove weeds and grass by hand is tremendous.

To sum up the matter, the company has purchased during the last year—

4 new boom-type ditchers,
2 air dump cars to go with each ditcher in service,
1 new Lidgerwood unloader,
2 new left-hand dirt plows,
4 tracklaying machines,
5 American rail loaders,
2 rail curvers,
14 supervisors' inspection cars,
1 portable rail saw,
1 permanent rail saw,
16 25-ton ball-bearing jacks,
1 weed burner,
13 motor-car mowing machines,

in addition to equipment already in service. During the next six months all section, bridge, extra gang and signal gangs will be equipped with motor cars.

DISCUSSION.

A. M. Clough (N. Y. C.) called attention to the omission of reference to tie tamping machines in the report and outlined his experience with 16 of these machines, in which he has found that each machine saved four men. T. Hickey (M. C.) stated that he has found that eight men with a machine will tamp 900 ft. of track per day. Mr. Hickey also emphasized the economy of locomotive cranes for a wide variety of maintenance of way work.

INSPECTION OF RAILS AT THE MILL

By C. W. GENNET, JR.,

Manager, Rail Inspection Department, Robert W. Hunt & Co., Chicago, Ill.

It is said that the earliest inspection of rails consisted chiefly of determining whether the size of the flaws in the flanges of the iron rails would permit of their concealment by dovetailing into them a piece of iron and afterward rubbing the patch with a mixture of scale and white lead. Later at the commencement of manufacturing Bessemer steel rails, which railroad officers were reluctant to adopt on account of their supposed brittleness, inspection became a more serious matter. Somewhat stringent specifications were required to be followed, and eventually chemists were employed to analyze the steel made. Captain Jones, then the head of the famous Carnegie Works, is reported to have said to Andrew Carnegie that "the damned chemists will spoil our business yet," but the new order of things had come to stay, and manufacturers, as well as railroad officers, were brought to a keen realization of the fact that with so important a subject as rails, their careful and systematic inspection was not only warranted, but necessary.

STARTED IN 1912.

It seems remarkable that for years the inspection consisted, apart from chemical and physical testing of the steel used, of merely examining the exterior or surface of the rails rolled; that is, (1) of insuring the proper fit of the template or gages; (2) of guarding against the shipment of rails containing flaws, seams and similar defects that can be seen on the surface, and (3) of assuring adherence to the desired mechanical finish of the rails with regard especially to the lengths, squareness of the ends, drilling of the bolt holes, etc. The idea never seemed to occur that steelmaking and the subsequent treatment that steel receives from the time it is made until it is finally rolled into rails is subject to all of the frailties to which either the misworking of the process or error of the human agency may contribute. But in 1912, when a very severe winter's record of rail failures had brought this subject to foremost attention, it was deemed advisable, by certain railroads, to inaugurate a system of greater or closer rail inspection—a system which has since become, we may say, internationally known as special inspection, because it was applied to many tons of rails exported to Russia. It is a system of inspection now recognized as essential by over 60 per cent of the railroad mileage of the United States and Canada.

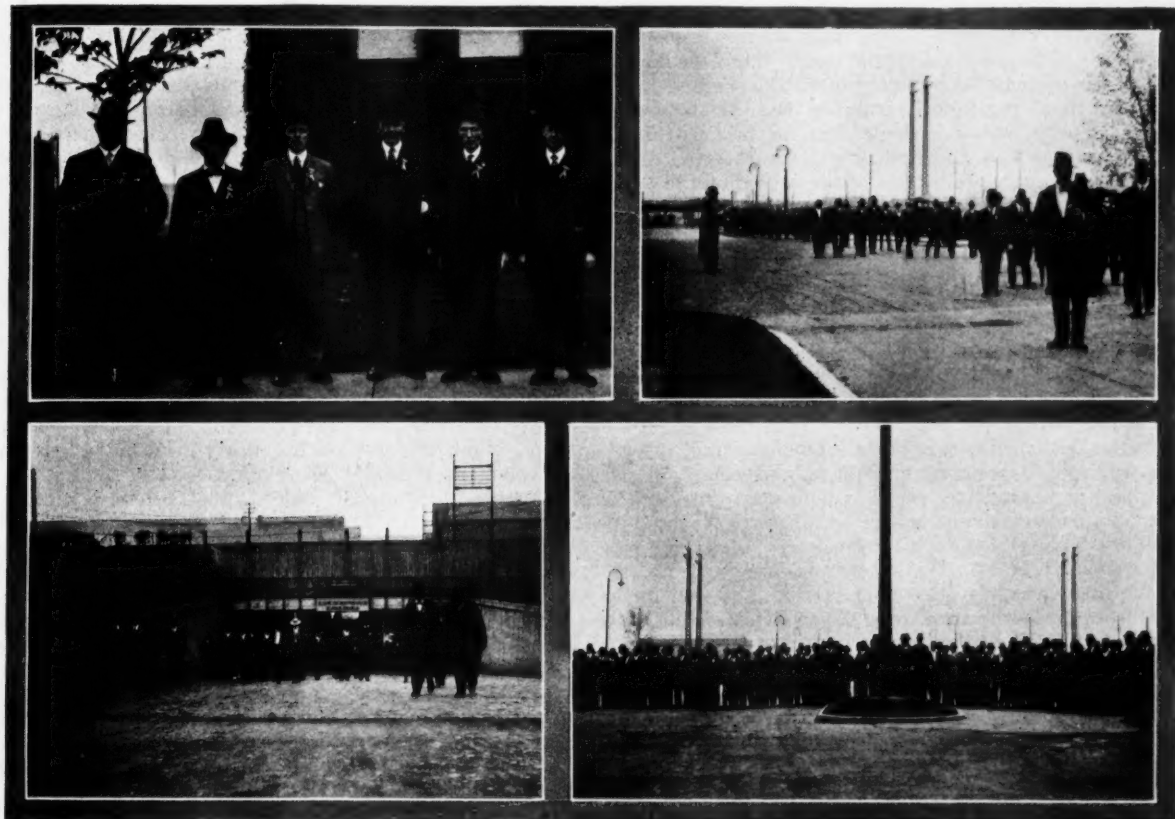
OPEN-HEARTH STEEL.

The open-hearth steel of to-day is made in large saucer-shaped furnaces in batches or heats of from 50 to 200 tons. These furnaces are first charged from one side with various mixtures of metal, frequently consisting of, say, 40 per cent of miscellaneous scrap and 60 per cent of molten pig iron, while limestone in some form is added to make a flux. Gas and air enter the furnaces first from one end and then from the other in such a way that an intense combustion occurs on the saucer or hearth holding the charge and with the result that the high temperature formed not only melts the charge, but causes it actually to boil. Various additions, such as iron ore or molten iron or limestone, are made and finally, after several hours, when the workmen, perhaps with the aid of chemists, decide that the proper stage has been reached, and steel of approximately the desired composition obtained, the furnace tap hole is opened and the mass of boiling steel permitted to flow out into a large ladle. Metallic manganese is then generally added and

a violent reaction follows, after which, when the ladle is full, it is carried over the ingot molds and the metal, under control of a workman, allowed to teem into the molds, one after another, through a small nozzle in the bottom of the ladle.

Briefly, this is the manufacture of what is known as open-hearth steel—a process entirely chemical in its fundamentals, but conducted on such a vast scale and under such obviously difficult conditions and subject to such inaccurate control as to be frequently open to many irregularities of composition and quality. The condition of the furnaces, the raw materials, the supply of gas and air, the temperature attained, and the condition of the accompanying mechanical contrivances are all mat-

the interior, and to bring them to a temperature sufficient to permit of rolling. Strange, but true, this matter of heating is left practically open to the judgment of the "heater," that is, there is no positive checking apparatus available to determine the precise fitness or temperature of the steel for rolling, and it is, of course, comparatively speaking, as easy to burn an ingot weighing four tons as it is to burn a horse shoe in the blacksmith's fire, while on the other hand, the ingots must be hot enough to be worked properly in the rolls. Finally the ingots are rolled forwards and backwards through the blooming mill into blooms, the piped and segregated top and rough bottom of each ingot is sheared off and discarded and the blooms passed to the rail mill for final rolling to the



SCENES ON THE TRIP TO GARY

SOME OF THE PAST AND PRESENT OFFICERS
LEAVING THE STEEL PLANT

ON THE WAY FROM THE TRAIN TO THE PLANT
AWAITING ENTRANCE TO THE MILLS

ters greatly affecting the character of the results. The seemingly simple process of filling the ingot molds with molten steel—that is, casting the ingots from which all rails are rolled—is frequently fraught with many difficulties, for the problem of controlling the flow of 100 tons of molten steel from the ladle through a little two-inch hole, and at the same time insuring ingots with good, clean, smooth sides and with a minimum amount of piping and segregation, is a more complicated one than would first appear.

After the molds have been filled and the steel partly solidified, the resulting ingots are stripped of the molds and put into the soaking pits, or rather, reheating furnaces, which are fired by gas. The real function of the soaking pits is to equalize the temperature of the ingots, which, of course, have cooled from their surface toward

section of rail desired. Then comes the sawing to the desired lengths, the stamping on of the proper heat number and letter, and lastly the hot straightening and final cooling of the rails. In the meanwhile certain short pieces have to be cut off, as specified for drop testing.

THE WORK IS SPEEDED UP.

In connection with this brief description, two important facts must be remembered; first, that all of the work is continuous for 24 hours a day and 6 days a week; and second, that the workmen are invariably paid on a tonnage basis, say, for 100 tons, with a bonus when this amount is exceeded in a stated time. Both of these conditions are almost a positive essential to the industry, as obviously and under most circumstances an increase of

production must be invited from the men. But no other conditions possible could probably introduce the liability for error, or the exercise of poor judgment that might result in bad quality that these do, for the temptation among the workmen to "speed up" some part of the process unnecessarily becomes quite irresistible at times and possibly to the detriment of the quality of the rails being made. For example, a furnace is due to be tapped at, say, seven o'clock in the morning by the day-turn men, but with a little urging it may be made ready and tapped by the night-turn gang, the night-turn men thereby receiving the credit and hence extra pay for the steel thus made. But that little extra urging which was necessary has perhaps resulted in the insufficient purification of the metal in the furnace, and while the steel may analyze correctly and pass the drop test satisfactorily, later service conditions of the rails in the track may reflect the influence of the undue haste. Thus the human element is brought very plainly into evidence and made at many times particularly manifest because the workman's identity with the single heat, or broken rail, is almost entirely lost, and he has in many cases no direct interest in the ultimate success of the individual rail.

WHAT INSPECTORS DO.

Special inspection provides a safeguard for all of the evils associated with the foregoing outline of the process of making rails. The system contemplates the employment of inspectors for duty day and night in each important department of the mill. These inspectors, employed in so far as possible because of their experience with the work of the department to which they are assigned, act as monitors in that department. Thus there are open-hearth or Bessemer steel inspectors, blooming mill inspectors, rail mill inspectors and drop test inspectors. Each man keeps an individual record of the work of his department, so made up that it is actually a historical record of each heat of steel made and the treatment it later receives in the rolling process. This record originating, of course, in the open-hearth or Bessemer works, is passed on to the inspectors in the succeeding departments so that each one in turn is able to anticipate just what conditions are to be met. The men are instructed not to interfere with the operation of the mills in any way except by appealing to the moral responsibilities and obligations of those in charge. This they do by first reporting verbally to the foreman in charge of the work in each department any deviation from recognized good practice, and then by confirming that report in writing to the higher officials in charge. Immediate opportunity is therefore afforded the manufacturer to divert the metal affected by bad practice or workmanship to other uses or orders, and to take such action as will prevent shipment of the rails which might otherwise go forward. This feature alone has resulted in the greatest check imaginable on errors of mill practice and lack of judgment due to the employment of workmen on the tonnage basis. The workmen apparently realize that an inspector—call him a policeman if you please—is watching every move with the interest of the final purchaser of the rails so much at heart that any evident carelessness or lack of good judgment may be promptly reported to the officials and consequent disciplining result. And this also has been the principal feature of special inspection that has so largely appealed to the officers of the manufacturing companies, for they, unquestionably desiring to make and ship only rails of the best quality and workmanship possible, have been quick to appreciate the great advantage gained from such a system.

The reports of the special inspectors are accumulated

eventually and made up to comprise a complete record of each heat rolled and this is furnished to the purchaser as desired. A splendid opportunity is thus afforded for keeping definite record of the data concerning the manufacture of each heat of rails and the later serviceability of those rails; in fact, a plan has been advanced whereby the linking together of the manufacturing record with the failed rail records might afford untold benefits in the solving of the ultimate problem of what constitutes good rails, but unfortunately this plan has not yet been taken advantage of except in isolated cases, but undoubtedly it will become more generally adopted by the railway companies.

Concrete cases showing the advantages of special inspection are many. Hardly a day passes but that some new development occurs to mark its function as of the greatest importance. Two simple ones will serve for illustration.

The open-hearth inspector complains of the general appearance of the steel as it comes from the furnace, possibly from the treatment it has received there. Its analysis proves correct and the mill decides to roll it into rails. At the drop test some of the pieces break and others stand, but as further testing ensues the preponderance of broken tests and their appearance is such that the mill then decides to take no chances and to reject the whole heat, even though under a strictly literal interpretation of the specifications it might be accepted.

A heat was reported by the special inspector to consist of 32 ingots. The mill claimed there were 33. A drop test was demanded from the "A" rail of every ingot. Thirty-two tests made gave deflections of approximately 1 in., while the test of the thirty-third ingot gave a deflection of over 2½ in., plainly showing that it was soft steel, the rails of which under ordinary circumstances would have been put into track.

From the foregoing you will note that a great advance has been made in recent years in the inspection of rails, but that no misunderstanding may occur, it should be emphasized that the inspection during manufacture—the special inspection above outlined—is additional in every way to the usual or ordinary kind which for so many years has been and is now applied. The actual rail inspectors, as they are called, go over carefully each and every rail rolled in a search for flaws, seams and similar surface defects, as well as to examine the mechanical finish of the rails. In this search and examination they are, however, greatly assisted by the results of the special inspection, for word comes to them from the men in the open-hearth or blooming mill or rail mill that some condition has occurred and to be on the lookout for evidence of that condition in the finished rails. Thus the work is progressive from beginning to end, from the time the furnaces are charged until the rails are on cars ready for shipment, but, of course, the chemical composition and the physical tests specified must continue to bear an important part in the effort to make good rails.

There is one remaining feature connected with the manufacture and inspection of rails which it seems not only fair to mention, but to impress you with it to the fullest extent. It is this: The best steel rails possible of making and the closest and most critical inspection will be of no avail whatsoever unless the rails are properly used by the railroads. You appreciate fully that the slightest nick in the right place can ruin the best of steel and its misuse in other ways frequently proves equally injurious. No doubt you have studied and discussed in your meetings the effects of improper tracklaying and maintenance matters, such as gage, the upkeep of joints

and the very important subject of drainage. These matters unquestionably have a direct influence on the best of rails, as well as the worst, and without your earnest and careful attention to the evils of the track, the problem of furnishing you with good steel becomes secondary rather than of foremost importance.

DISCUSSION.

This paper brought out considerable discussion regarding the difficulties commonly found in new rails when received on the line. W. Shea (C. M. & St. P.) reported the trouble he has experienced with burrs on the lower side of the head at the ends of rails. He has found that these burrs are a common source of breakage of angle bars and joints, and to eliminate them he sends six men ahead of his rail relaying gangs to remove them. Mr. Gennett explained the manner in which the burrs are chipped and filed from the ends of the rails after rolling at the mill and pointed out the danger of filing too much metal off and creating a slight bevel which would lead to early battering of the joints. He urged milling the ends of the rails to remove this difficulty, but stated the objections of the mills to the inauguration of this practice.

TRIP TO GARY.

Through the courtesy of the Illinois Central and the Chicago, Lake Shore & South Bend railways, a special train was provided on Thursday afternoon on which 300 men went to Gary, Ind., where they visited the rail mill of the Illinois Steel Company and had an opportunity to observe the manufacture of steel rails from the time the ingots were removed from the soaking pits until they were loaded on cars for shipment.

CLOSING BUSINESS

At the business meeting on Thursday morning the following officers were elected for the ensuing year: President, A. Grills, general roadmaster, Grand Trunk, St. Thomas, Ont.; first vice-president, J. B. Oatman, roadmaster, Buffalo, Rochester & Pittsburgh, Du Bois, Pa.; second vice-president, J. W. Powers, supervisor, New York Central, Oswego, N. Y.; secretary, P. J. McAndrews, roadmaster, Chicago & North Western, Sterling, Ill.; treasurer, Coleman King, supervisor, Long Island, Jamaica, N. Y.; members executive committee, four years, George Beckingham, superintendent of track, Grand Trunk, Montreal, Que.; J. P. Corcoran, roadmaster, Chicago & Alton, Bloomington, Ill.; three years, A. M. Clough, supervisor, New York Central, Batavia, N. Y.; W. Wiltsee, principal assistant engineer, Norfolk & Western, Roanoke, Va.; two years, J. S. McGuigan, roadmaster, St. Louis-San Francisco, St. Louis; one year, F. J. Meyer, roadmaster, New York, Ontario & Western, Walton, N. Y.

Chicago was selected as the location for the next convention and the executive committee was given authority to change this location should unforeseen conditions arise which would make this desirable.

The total registration of members of the Roadmasters' Association exceeded 250. Including guests, a total of over 350 men registered, a larger number than at any previous convention. A larger number of roads were also represented than at any previous meeting. An interesting fact brought out in the registration of members was that the average length of railway service of all roadmasters registering was approximately 31 years. The maximum length of service reported by any roadmaster was 52 years.

The report of the secretary showed 102 new members

received during the year and a total membership of 964. The treasurer reported cash on hand in the treasury of over \$1,300.

BANQUET ON WEDNESDAY EVENING

The Track Supply Association gave a banquet to the members of the Roadmasters' Association at the Auditorium Hotel on Wednesday evening, over 300 men being present. M. J. Gormley, assistant to the president of the Chicago & North Western and general agent transportation, Central District, American Railway Association, in charge of military transportation matters, spoke on the transportation problem incident to the war. He outlined in considerable detail the organization which the railways have provided to co-operate with the government in the handling of troops and military supplies and the unusual efficiency with which the railways are doing their part. Other speakers included present and past officers of the Roadmasters' and the Track Supply associations.

THE TRACK SUPPLY EXHIBIT

The Track Supply Association presented an exhibit in rooms adjoining the convention hall. All of the available space was allotted and 46 firms were represented. These exhibits attracted particular attention this year owing to the general interest railway men are showing in improved equipment and devices which will reduce the amount of labor required.

The officers of the Track Supply Association for the past year were: President, R. A. Van Houten, Sellers Manufacturing Company, Chicago; vice-president, E. T. Howson, *Railway Maintenance Engineer*, Chicago; secretary-treasurer, W. C. Kidd, Ramapo Iron Works, Hillburn, N. Y.; directors, F. A. Preston, P. & M. Company, Chicago; J. J. Cozzens, Union Switch & Signal Company, New York, and F. A. Barbey, Frictionless Rail, Boston, Mass.

The following is the list of the firms which presented exhibits, together with the materials exhibited, and the names of their representatives.

Ajax Rail Anchor Company, Chicago; rail anchors; H. G. Elfborg, G. N. Holmberg and A. W. Holmberg.

Alexander Milburn & Co., Baltimore, Md.; carbide lights and oxy-acetylene welding and cutting apparatus; E. C. McNutt.

American Steel & Wire Company, Chicago; steel fence posts and fence; M. E. Evans, A. W. Froude, J. Alexander, L. P. Shanahan, J. Collins, C. Boone and B. Ryder.

American Valve & Meter Company, Cincinnati, Ohio; economy switch stands, Anderson interlocking switch stands and safety switch locks; J. T. McGarry and F. C. Anderson.

American Hoist & Derrick Company, St. Paul, Minn.; transparencies of the American Railway Ditcher; Edward Coleman and H. O. Washburn.

Anti-Creeper Corporation, New York; rail anchors; O. Metcalf, C. H. Genscher, T. J. Bowman, E. L. Mills, P. B. Brown, A. J. Dinklage and E. T. Evans.

Barrett Company, New York; Tarvia, shingle stain, carbosota, creosote oil, semaphore roofing, multi-shingles and everjet paint; E. J. Caldwell, C. F. Ames, J. R. McVay, John Ross, H. W. Fleming, Tom A. Warton and K. C. Barth.

Bethlehem Steel Company, South Bethlehem, Pa.; New Century adjustable switch stands and "Steelton" positive switch stands; Robert E. Belknap, Neil E. Salsich and John F. Hennessy.

Carbic Manufacturing Company, Duluth, Minn.; carbic lights; Gordon Peterson and H. N. Haberstroh.

Chicago Malleable Castings Company, Chicago; Thomas rail anchor tie-plates; J. S. Llewellyn, W. M. Osborn and Ralph Schmidt.

Crerar, Adams & Co., Chicago; Calumet track drills, Vieka bonding drills, carbic lights, track jacks, journal jacks, car jacks and Calumet die starters; Russell Wallace, W. I. Clock, George Bassett, J. A. Martin, C. Clifford, C. Gregory and R. Bullard.

Duff Manufacturing Company, Pittsburgh, Pa.; Barrett track

jacks, Duff standard and high-speed ball-bearing screw jacks and journal jacks; C. M. Thulin and E. A. Johnson.

Fairbanks, Morse & Co., Chicago; No. 36 One Man inspection motor car; A. A. Taylor, E. C. Golladay, D. K. Lee and G. W. Lewis.

Fairmont Gas Engine & Railway Motor Car Company, Fairmont, Minn.; motor cars; D. C. Shephard.

The Frictionless Rail Company, Boston, Mass.; special section rails for curves; F. A. Barbey, B. W. Simonds and T. F. Dwyer, Jr.

Hauck Manufacturing Company, Brooklyn, N. Y.; thawing outfits and kerosene-burning torches; G. A. Nelson, W. C. Squires and C. P. Cogswell.

Hayes Track Appliance Company, Richmond, Ind.; Hayes derails; S. W. Hayes and B. W. Slauterback.

R. W. Hunt & Co., engineers, Chicago; inspection of materials; C. W. Gennet, Jr., and J. J. Clark.

Indianapolis Brush & Broom Company, Indianapolis, Ind.; track brooms; F. R. Lay and George Lemaux.

Indianapolis Switch & Frog Company, Springfield, Ohio; electric welder and manganese track worker; J. C. Jameson.

Ingersoll-Rand Company, Chicago; pneumatic tie tampers; W. H. Armstrong, Chas. Dougherty and C. W. Melcher.

Lackawanna Steel Company, Buffalo, N. Y.; hook shoulder tie-plates, grooved-head angle bars, Abbott rail-joint plates and welded high T-rail joints; A. P. Van Schaick, J. Hench, F. E. Abbott and A. H. Weston.

Madden Company, Chicago; track labor-saving devices; H. C. Holloway and T. D. Crowley.

Mudge & Co., Chicago; motor cars; R. G. Sinclair, F. Posson and George W. Bender.

National Lock Washer Company, Newark, N. J.; nut locks; J. Howard Horn, R. L. Cairncross, John T. Patterson and Alvin T. Thompson.

National Malleable Castings Company, Cleveland, Ohio; rail anchors, rail braces and tie-plates; J. J. Byers and T. W. Aish-ton.

Oxweld Railroad Service Company, Chicago; oxygen and acetylene system; George Thompson, E. A. Woodworth and L. C. Ryan.

Pocket List of Railroad Officials, New York; J. Alexander Brown and C. L. Dinsmore.

P. & M. Company, Chicago; P. & M., Vaughan and Henggi rail anchors; Fred A. Preston, John Reagan, L. O. Henggi, John E. Mahoney, S. M. Clancey, Alvar R. Sutter and P. B. Samuelson.

Q. & C. Company, New York; rail clamps, derails, rail and step joints; J. L. Terry, R. B. Quincy, C. M. Brennan, A. R. Horn and A. Robertson.

Rail Joint Company, New York; Weber, Continuous, Troy—plain, insulated and step joints; V. C. Armstrong, G. H. Larson, A. C. Chapman, E. F. Schermerhorn, W. S. Boyce, G. T. Willard, I. N. Towne, H. C. Hickey, C. B. Griffin, J. P. Norton and Charles Jenkinson.

Railway Review, Chicago; W. M. Camp, Elmer Gougeon and H. A. Smith.

Railroad Supply Company, Chicago; tie-plates; A. H. Smith and H. G. Van Nostrand.

Ramapo Iron Works, Hillburn, N. Y.; solid-rolled double-shoulder switch plates and automatic safety switch stands; W. C. Kidd, Arthur Gemunder, Thomas E. Akers and Douglas E. Snow.

Reading Specialties Company, Reading, Pa.; rail benders, guard rail clamps, compromise joints, car replacers and fasteners, tie spacers and reversible rail benders; B. John Buell and J. J. O'Connell.

Henry Roos Foundry Company, Chicago; Hardick locked and covered turn-buckles, boltless-head rods; William Hardick and L. A. Ogden.

Sellers Manufacturing Company, Chicago; tie-plates; J. M. Sellers, R. A. Van Houten and G. M. Hogan.

Simmons-Boardman Publishing Company, New York and Chicago; E. T. Howson, L. B. Sherman, W. S. Lacher, J. H. Cross, H. A. Beardsley and J. H. Bryan.

Simple Gas Engine Company, Menasha, Wis.; general utility gas engines; John Hrubesky, F. J. Oberweiser and John G. Walter.

Southern Railway Supply & Equipment Company, St. Louis, Mo.; Saunders car stopper; W. D. Achuff and Lawrence Boswell.

Templeton, Kenly & Co., Ltd., Chicago; Simplex jacks; A. C. Mills, J. H. Hummel and W. B. Templeton.

Track Specialties Company, New York; Superior mechanical and hand-operated derails, guard-rail clamps, compromise rail joints, Superior rail benders, Superior rail joints, guard rail braces, tie-plates, padded tie-plates, rail braces, foot-guards, slide-plates and braces; J. H. Bodkin.

Union Switch & Signal Company, Swissvale, Pa.; Keystone insulated rail joint; J. J. Cozzens and J. D. Roett.

Verona Tool Works, Pittsburgh, Pa.; track tools, gages and levels; H. C. Mull, E. Woodings and H. Fischer.

Walls Frogless Switch & Manufacturing Company, Kansas City, Mo.; electric-operated frogless switches; C. E. Ennis and C. W. Walker.

Wyoming Shovel Works, Wyoming, Pa.; chrome nickel steel, heat-treated track shovels; H. T. Potter, G. E. Geer and H. C. Emery.

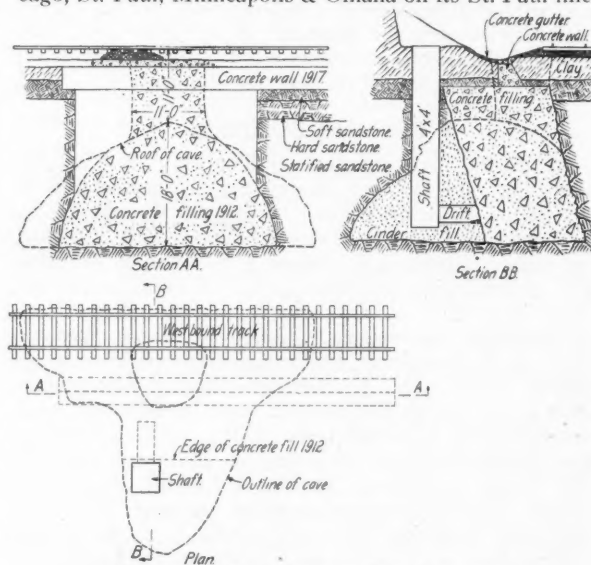
At the annual election held on Wednesday morning the officers chosen for the following year were: President, E. T. Howson, *Railway Maintenance Engineer*, Chicago; vice-president, J. J. Cozzens, Union Switch & Signal Company, New York; secretary-treasurer, W. C. Kidd, Ramapo Iron Works, Hillburn, N. Y.; directors, E. Coleman, American Hoist and Derrick Company, St. Paul, Minn. F. A. Barbey, Frictionless Rail, Boston Mass., holds office as director for another year, while R. A. Van Houten, retiring president, becomes director ex-officio.

CAVE IN ROCK CAUSES TRACK SETTLEMENT

By H. RETTINGHOUSE,

Chief Engineer, Chicago, St. Paul, Minneapolis & Omaha, St. Paul, Minn.

IN 1906 a circular depression about nine feet in diameter appeared suddenly, and without any previous warning, adjacent to and partly under the main track of the Chicago, St. Paul, Minneapolis & Omaha on its St. Paul line,



PLAN AND SECTIONS OF THE CAVITY

about 1½ miles east of Roberts, Wis. The depression was found by soundings to extend about 30 ft. below the base of rail, but unfortunately no further examinations were made at that time and after filling the depression with some four or five cars of slag, the matter was dropped. Nothing further occurred until July, 1912, when during the construction of a second track a depression of the same dimensions again formed at the identical location without any warning. After lining the track over, the depression was filled with cinders.

After an examination by the engineering and track department it was concluded that the caving in of the ground was not due to a so-called sink hole, but to a cavity in a stratum of sandstone, the top surface of which is about eight feet below base of rail. To guard

permanently against further trouble the part of the cavity next to the track was filled with concrete. However, after removing the material previously filled in, no thorough examination was made of the nature or extent of the cave to the north of the track, but it was the theory of those in charge of the repair work that it extended indefinitely. The site of the trouble is in a cut about six feet deep, and in order to prevent as far as possible the seeping of surface water into the ground over the cave the side ditch over the cavity was paved with rubble stone and the joints were grouted thoroughly. A surface ditch was also constructed along the north side of the cut to carry off the bulk of the surface water tributary to the cut ditch.

In April, 1917, a slight settlement of the surface appeared near the track at this point, so it was then decided to make a more thorough examination to determine what measures should be taken to cure the difficulty permanently and to eliminate ground for any further concern. Under the direction of the writer, a shaft curbed with timber was sunk to the bottom of the cave, from which drifts were driven in all directions, and the extent of the cave and the concrete filling and, in fact, the nature of the entire conditions was determined accurately. The results of this survey are shown on the drawings. It developed that the cave had a dome-like roof, which had broken down as a result of the vibrations of passing trains. To preclude any possibility of disturbance of the track through movement of the ballast and sub-grade material, the concrete filling was raised in the shape of a parapet. The shaft, which was substantially curbed and provided with a ladder, will be left in position for some time to permit future investigation in case any disturbance occurs from causes unknown at this time.

TREATING LABORERS CONSIDERATELY

WHILE the old policy of "driving" track laborers is being done away with rapidly, there is still room for improvement in the treatment generally accorded to this class of labor. Better treatment for track labor is advisable for more than humanitarian reasons. It pays dividends. The laborer who is treated fairly finds his work much more pleasant than the one who is driven like a mule every working minute; who is roundly abused for his shortcomings, but never praised for the good work he does. Moreover, men who are treated like intelligent human beings are much more likely to stay on the job than those who are not. This feature alone is worthy of careful consideration in these days of scant labor supply. It has been found, where laborers have been treated with consideration, that when it is necessary to do rush work they are much more inclined to do their best and co-operate fully with their superiors.

Men who are driven every minute they are under the boss' eye will not fail to seize every possible chance to soldier when the boss is busy out of sight. All this does not mean, of course, that lax discipline is to be tolerated; the foreman must always maintain his ascendancy and personally see that his orders are carried out.

Men who display special aptitude should be encouraged, as track labor is skilled work, and a track laborer who knows his business is worth much more than a green hand who has nothing but a strong back to recommend him. The value of a good, experienced track laborer is great enough to justify year-round employment, and it is the opinion of many experienced railroad men that this policy is much more economical than that of hiring a green gang every spring and firing it in the fall.—*Rock Island Employes' Magazine.*

THE MATERIAL MARKET

THE long heralded reduction in the prices of iron and steel as finally agreed upon between the War Industries Board and the manufacturers was announced on September 24. Only a few general prices have been made available thus far but these indicate material reductions below the prices prevailing just before the announcement. Thus the agreed price on pig iron is \$33 per gross ton; on steel bars, 2.9 cents per lb.; on shapes, 3 cents, and on plates, 3.25 cents; these being base prices for both Pittsburgh and Chicago. Just previous to this announcement the price was around \$50 for pig iron, 4½ to 5 cents for bars, 4 to 6 cents for shapes and 8 to 10 cents for plates. As a prelude to the new prices a material reduction in quotations took place in a number of commodities during the course of the last month.

Reduction in the structural steel business mentioned last month is now more pronounced. Contracts for structural steel, recorded by the Bridge Builders and Structural Society for the month of August, were only 38 per cent of the plant capacities of the country, the smallest percentage since 1914, when 35 per cent was recorded. The August contracts represent a total of 68,400 tons, as compared with 74,000 tons for July, 85,500 for June and 102,000 for May.

The new prices of track fastenings have not been published. The last prices given, unchanged for a month, are as follows: Angle bars, 3.75 to 4.00 cents at Pittsburgh, 3.25 to 4.00 cents at Chicago; spikes, 6.50 to 7.00 cents at Pittsburgh and 4.25 to 5.25 cents at Chicago. Track bolts are 5.50 to 8.00 cents at Pittsburgh and 5.25 to 6.50 cents at Chicago. Tie plates remain \$75 per ton.

Wire nails are now quoted at \$4 per keg (100 lbs.), but some sales have been made at \$3.50; galvanized wire is \$4.65 per 100 lb., galvanized barbed wire is \$4.85. The price of cast iron pipe remains \$68.50 per ton for four-inch pipe and \$65.50 per ton for six-inch or larger.

No railway orders of any importance have been noted. The government is inquiring for about 1,000,000 tie plates, but no orders have been placed. The Baltimore & Ohio has inquiries for 2,000 tons of structural steel and 1,500 tons of reinforcing steel for a freight station at Cleveland.

Second-hand material and scrap have also suffered a further decrease in price. Heavy melting steel was \$36 to \$38 per ton at Pittsburgh and is now \$33 to \$35. There has also been some falling off in the price of relaying rails and rails suitable for rerolling, the former being priced at \$45 to \$55 per ton and the later at \$38 to \$45; frog and switch scrap runs from \$29 to \$34. Almost nothing is heard about new rails, although considerable interest is attached to an order for a small tonnage of standard rails taken from stock which were sold to an eastern railroad at \$95 per ton.

The situation in the lumber market is not so readily defined. There has been a decrease in some items of yellow pine, while there has been a small increase on Douglas fir. A slight falling off has taken place in the shipments of lumber for July as compared to June, but there has been a still greater decrease in the production.

After remaining stationary for a period of three months, there has been rather a general drop of about ten cents in the price of cement. The price per barrel in carload lots, not including package, is now \$1.91 at Pittsburgh, \$1.81 at Chicago, \$2 at Detroit and Toledo, \$2.08 at Minneapolis and St. Paul, and \$1.93 at Peoria and Milwaukee.

GENERAL NEWS DEPARTMENT

THE BALTIMORE & OHIO saved 6,238 cars in the handling of less-than-carload freight in July compared with the same month last year through heavier loading. This company handled 12,000 tons more package freight in 4,000 less cars than a year ago.

THE UNION PACIFIC has issued a booklet containing information of interest to those who have had relatives called to the colors. The booklet gives answers to more than a thousand questions regarding the location of the new army training camps and other matter concerning the various branches of the service.

NINE ANTHRACITE COAL ROADS moved 753,451 more cars of anthracite coal during April, May, June and July of this year than during a similar period last year. This is an increase of over 20 per cent. In the same period 110 roads handled 3,448,999 cars of bituminous coal, an increase of 28 per cent over 1916.

THE TEXAS COURT OF CIVIL APPEALS reversed a judgment for the plaintiff in a crossing accident case and rendered judgment for the railroad, because of the contributory negligence of the driver of the automobile, for whose injuries the action was brought, in failing to keep a lookout for a train before driving on the crossing.

THE ST. LOUIS-SAN FRANCISCO has established a bureau for the employment of women at Springfield, Mo., through which women will be recruited for service on this road. To train them for their duties, a school has also been organized under the direction of the company. In filling positions preference will be given to members of families of present employees on the road.

THE SOUTHERN PACIFIC, because of the increased value of scrap paper, has adopted the policy of retaining magazines, old records, newspapers, etc., and sending them to the stationery storekeeper at West Oakland, Cal. During the month of June the West Oakland collecting office disposed of nearly 16,000 lb. of waste paper that had been forwarded from all parts of the Pacific system.

ROBERT S. LOVETT, chairman of the executive committee of the Union Pacific and a member of the War Industries Board of the Council of National Defense, has been designated by the President to determine the priority of shipments. His duty will be to determine those articles and materials which are most essential to the winning of the war and which should be given precedence in production and distribution.

THE INTERSTATE COMMERCE COMMISSION has issued specifications in pamphlet form for maps, charts and schedules of telegraph and telephone properties owned by railroad, telegraph, cable and telephone companies for valuation purposes, effective August 1, 1917. These specifications describe in detail the character of the maps desired, the manner of their preparation and other requirements for guidance in their preparation for filing with the division of valuation.

THE PENNSYLVANIA has purchased a machine to make quick-bend tests of rails in conjunction with the standard drop test and has installed it in a car so that it can be moved from one mill to another as rails are being rolled for this road. This car was placed in service last April. The results which have been obtained with this method of testing rails so far indicate that the quick-bend test shows more clearly than the drop test the character of the rails now being rolled.

THE NEW YORK PUBLIC SERVICE COMMISSION for the First district has adopted an order directing the New York Central, the Long Island and the Staten Island Rapid Transit to keep the gates at 145 highway crossings closed between midnight and 5 a. m. as a measure of protection against vehicle traffic. After August 22, when the new rule takes effect, the late returning automobilist will have to wake the crossing watchman before he can cross a railroad track inside the limits of New York City.

TWELVE HUNDRED "WAR GARDENS" are being cultivated this summer on vacant land of the Pennsylvania Railroad east of

Pittsburgh by employees for the use of themselves and their families. The value of the crops raised will probably exceed \$250,000. More than 1,000 acres have been planted and are now producing crops of potatoes, peas, beans, tomatoes, corn and various other garden vegetables. The average size of each plot of railroad land, tilled by an employee, is slightly less than an acre.

THE PENNSYLVANIA RAILROAD thus far has had 2,540 of its employees enter the Army and Navy of the United States as volunteers, who have been granted furloughs from the railroad service. Of this number 75 have been appointed commissioned officers and 30 are student officers in various officers' training camps. The remainder, numbering 2,442, are enlisted men in the Army and Navy. The commissioned officers include 1 colonel, 1 lieutenant-colonel, 2 majors, 21 captains, 23 first lieutenants, 22 second lieutenants, 3 ensigns and 1 pay clerk.

THE RAILWAY SITUATION IN RUSSIA is such that J. F. Stevens chairman of the railroad commission making an investigation of the railways in Russia, has telegraphed to Washington requesting that an American railway unit of 129 men, consisting of division superintendents, dispatchers, trainmasters, engineers, master mechanics and one telephone expert, be sent to Russia to educate the Russian railway men in American operating methods. The request has been referred to S. M. Felton, director general of railways in charge of the organization of railway forces for service abroad.

THE RAILWAY BUSINESS ASSOCIATION is enlisting the co-operation of trade organizations all over the country to help win the war by making every freight car do all it can to conserve the car supply. According to a recent report 40 organizations have already indicated their willingness to co-operate in this and a vigorous campaign is on foot to increase the number of associations participating in this movement. These bodies are national, state and local organizations which have recommended to their members the use of performance record blanks through which the president of each company can measure from month to month the progress made and in this way prepare for the heavy traffic of coming months by conserving the car supply systematically.

A STRIKE OF SWITCHMEN belonging to the Brotherhood of Railroad Trainmen was called on 19 roads in the Chicago switching district on July 28. The strike lasted about two days when, through the combined efforts of officers of the other three railway brotherhoods, who would also have been affected by this strike, a settlement was reached. The strikers wished to establish the closed shop in favor of members of their organization and to deprive the railroad managements of the power to appoint yardmasters and assistant yardmasters from outside their ranks. The final settlement agreed upon was that the men return to their positions at once without prejudice or loss of seniority, and that the questions at issue be settled between the Commission of Eight at New York and the Managers' Conference Committee.

THE EMPLOYEES OF THE ILLINOIS CENTRAL have organized a co-operative farm project called the Volunteer Agricultural Corps of the Illinois Central, and the company has turned over 90 acres of company property at Wildwood (130th street, Chicago) for this purpose. Employees taking from 2 to 18 shares become members of the organization, each share requiring that the owner pay into the treasury \$1 per month for a period of 6 months beginning April 1, 1917. This money is used to cultivate the property. The products of the farm are sold at prevailing commission market prices and this money is also paid into the treasury for expenses and to provide working capital for similar operations next year. Should there be a surplus the money will be divided pro rata among the members of the organization. The officers of the organization consist of a colonel, lieutenant colonel, major, eight trustees and a general secretary and treasurer.

PERSONAL MENTION

GENERAL

J. G. RODGERS, general superintendent of the Northern Division of the Pennsylvania Railroad, with headquarters at Buffalo, N. Y., who has been appointed assistant to the president, effective September 20, entered the service of the Pennsylvania as a rodman in 1882 and rose through the positions of assistant engineer and supervisor before entering the operating department as superintendent. Until otherwise ordered, he will continue to discharge his present duties in Washington as general agent of transportation for the Railroads' War Board of the American Railway Association.

HOWARD G. KELLEY, who has been elected president of the Grand Trunk and of the Grand Trunk Pacific, succeeding E. J. Chamberlain, resigned, is a past president of the American Railway Engineering Association and had gained most of his railway experience in the engineering department. He was born at Philadelphia, Pa., on January 12, 1858, and is a graduate of the Polytechnic College of Pennsylvania. He entered railway service as an assistant engineer on location with the Northern Pacific in 1881. From 1887 to January, 1890, he was resident engineer and superintendent of bridges and buildings of the St. Louis-Southwestern, becoming chief engineer on the latter date, which position he held until March 1, 1898, when he became consulting engineer of the road. He was also appointed chief engineer of the Minneapolis & St. Louis, in which position he remained until July 3, 1907, his jurisdiction being extended over the Iowa Central also in July, 1900. On July 4, 1907, he became chief engineer of the Grand Trunk, and on October 1, 1911, he was appointed vice-president in charge of construction, maintenance and operation, which position he has held until his recent election.

ENGINEERING

H. A. WOODS, assistant chief engineer of the Grand Trunk Pacific, with headquarters at Winnipeg, Man., has resigned.

H. R. MANBY, acting superintendent and engineer of the Tennessee Central at Nashville, Tenn., has been appointed superintendent and engineer, with the same headquarters.

H. B. HOLMES, chief engineer of the Kansas City, Mexico & Orient, with headquarters at Kansas City, Mo., has resigned to become associated with Cloverdale & Colpitts, consulting engineers with offices in New York.

I. M. BROWN, supervisor of track of the Indianapolis Terminal division of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Indianapolis, Ind., has been appointed acting engineer maintenance of way with the same headquarters. He succeeds C. F. Hinchman, who has been granted a leave of absence.

O. B. LACKEY, resident engineer of the Southern at Old Fort, N. C., has been promoted to supervising engineer, with headquarters at Washington, D. C., succeeding M. P. Northam, who has resigned to accept service elsewhere. Mr. Lackey began railway work in 1907 as transitman for the Southern at Knoxville, Tenn. Subsequently he served as inspector, assistant engineer, assistant roadmaster, and in May, 1914, became resident engineer at Knoxville. Since the heavy floods damage suffered by the Southern in the Carolinas and Virginia during the summer of 1916, he has been engaged in the reconstruction work which this necessitated, with headquarters at Old Fort.

LOUIS C. FROHMAN, whose appointment as principal assistant engineer of the Florida East Coast, with headquarters at St. Augustine, Fla., was announced in the issue of last month, has been with that company since September 1, 1916. Mr. Frohman was born in Cincinnati July 18, 1888, and attended the Ohio Northern University, first entering railway service on the Baltimore & Ohio South Western in November, 1909. On January 1, 1913, when the Baltimore & Ohio South Western offices were consolidated with those of the Cincinnati, Hamilton & Dayton

at Cincinnati, he was appointed assistant engineer in the office of the engineer maintenance of way. He subsequently became assistant engineer in the office of the district engineer of maintenance of way of the Cincinnati, Hamilton & Dayton at Cincinnati, and assistant division engineer of the Cincinnati-Toledo division at Dayton, Ohio. On September 1, 1916, he resigned this position to enter the service of the Florida East Coast as assistant engineer maintenance of way, with headquarters at St. Augustine, Fla.

G. C. WENDING has been appointed assistant engineer on the Louisville & Nashville, with headquarters at Nashville, Tenn., succeeding L. L. Adams, who has received a commission as first lieutenant in the Engineer Officers' Reserve Corps. W. E. BAKER has been appointed assistant engineer, with headquarters at Jackson, Ky., succeeding F. M. Cates, resigned. G. R. SMILEY has been appointed assistant engineer on the Louisville & Nashville, with headquarters at Louisville, Ky., succeeding L. L. Morton, who has received a commission as captain in the Engineer Officers' Reserve Corps.

JOHN M. GRANT, whose appointment as engineer on the Chicago, Peoria & St. Louis at Springfield, Ill., was announced in the September issue of the *Railway Maintenance Engineer*, was born at Ludington, Mich., on November 18, 1882. He graduated from the University of Michigan in 1906 and entered railway service with the Chicago, Peoria & St. Louis on August 1, of that year. From 1907 to 1910, he was employed on the building of the Panama Canal and in 1912, he became associated with the Chicago, Milwaukee and St. Paul as a resident engineer. In 1915, he was appointed assistant engineer of the Chicago, Burlington & Quincy, which position he held until he became engineer on the Chicago, Peoria & St. Louis, as already noted.

CHARLES S. ROZZELLE, whose appointment as assistant division engineer of the Baltimore & Ohio Southwestern at Blanchester, Ohio, was announced in these columns last month, was born at Washington, D. C., on June 18, 1891. He entered railway service with the Baltimore & Ohio on June 11, 1910, as an axeman on surveys and later served successively as chainman and rodman. In 1912, when the Baltimore & Ohio started making improvements in West Virginia and Pennsylvania, he was transferred to the construction department as a rodman. In June, 1915, he entered the maintenance of way department as a rodman and served successively as a draftsman and transitman. In May, 1916, he became assistant supervisor of track with headquarters at Carlyle, Ill., and was later transferred to Blanchester, Ohio, where he served in the same capacity until his recent appointment as assistant division engineer.

TRACK

JOHN SHEPHERD has been appointed track supervisor on the Louisville & Nashville, with headquarters at Louisville, Ky., succeeding John Nichols, resigned.

R. LAVON, roadmaster on the Birmingham division of the Louisville & Nashville, has been transferred to the eastern Kentucky division, with headquarters at Ravenna, Ky.

GEORGE KUHN has been appointed roadmaster on the Omaha division of the Missouri Pacific with headquarters at Auburn, Neb., succeeding G. Miller, assigned to other duties.

P. H. MCFADDEN has been appointed roadmaster of the Northern Pacific, with headquarters at Livingston, Mont., succeeding E. M. Riton, deceased. Acting roadmaster, John McDougall, has been assigned to other duties.

M. J. DENIFF, supervisor on the Erie at Port Jervis, N. Y., has been transferred to Jersey City, N. J., succeeding P. J. Kerwin, who has been made an inspector of the Public Service Commission, First District, of the state of New York.

I. B. NELSON has been appointed assistant roadmaster fourth district, Havre division of the Great Northern, succeeding James Sullivan, who was transferred to the Montana division. I. E. VAUGHN has been appointed assistant roadmaster second district, succeeding C. T. Rasmussen, resigned. F. JENSEN, section foreman of the Butte division, has been appointed assistant roadmaster on the third district, Havre division, in place of Mr. Vaughn.

CHARLES A. MAYNOR, supervisor on the Louisiana division of the Illinois Central, with headquarters at Jackson, Miss., has been promoted to roadmaster on the Mississippi division with headquarters at Water Valley, Miss., succeeding J. J. DESMOND, who has been transferred to the Louisiana division with headquarters at McComb, Miss., in place of Thomas Quigley, promoted to trainmaster.

WILLIAM E. FITZSIMONS, whose appointment as roadmaster on the Fargo division of the Northern Pacific was announced in last issue, was born in June, 1885. He graduated from the Central high school at St. Paul and entered services with the Northern Pacific in 1905, all of his railroad experience having been with this road, except one year in the engineering department of the Great Northern. He was engaged in various positions in the engineering department of the Northern Pacific, as chairman, rodman, instrument man and assistant engineer, holding the last position at the time that he was appointed roadmaster on the Fargo and Southwestern, and Casselton branches, with headquarters at Dilworth, Minn.

BRIDGE

J. M. SALMON has been appointed bridge engineer of the Louisville & Nashville, with headquarters at Louisville, Ky., succeeding F. A. BUSSE, who has resigned to enter military service.

A. F. STOTLER, supervisor of bridges and buildings of the Northern Pacific with headquarters at Seattle, Wash., has been appointed division engineer of the lines west of Ellensburg, Wash., with headquarters at Tacoma, Wash., succeeding B. L. CROSBY, who has been granted an indefinite leave of absence on account of illness.

J. W. PRICE, assistant supervisor of water service on the Kentucky division of the Illinois Central with headquarters at Princeton, Ky., has been promoted to supervisor of water service on the same division, succeeding I. B. TANNER, who has resigned to become superintendent of the railway water service department of the Joseph E. Nelson & Sons, general contractors, Chicago, effective August 1. Mr. Price entered railway service on April 27, 1913, with the Illinois Central as a pump repairman on the Kentucky division. On March 1, 1915, he was promoted to assistant water supply foreman on the same division, and on June 1, 1916, was transferred to the valuation department, in which capacity he checked all pump stations on the Yazoo & Mississippi Valley. On August 1 of the same year he returned to his position as assistant division foreman. On August 1, 1917, he was promoted to water supply foreman, as already noted.

J. P. HANLEY, supervisor of water service on the Illinois division of the Illinois Central with headquarters at Chicago, has been promoted to inspector of water service on the Illinois Central and the Yazoo & Mississippi Valley, with headquarters at Chicago. A. L. GRAHAM, assistant supervisor of water service on the Illinois division, has been promoted to supervisor of water service, succeeding Mr. Hanley, effective September 1.

E. G. GIBSON, who has been appointed supervisor of bridges and buildings on the Denver & Rio Grande, with headquarters at Gunnison, Colo., was born at Wheeling, W. Va., on November 18, 1880. He entered railway service as a carpenter with the Denver & Rio Grande on August 3, 1907, and in July, 1908, was promoted to foreman of bridges and buildings, which position he held until his recent appointment as supervisor of bridges and buildings.

PURCHASING

C. N. DAVIDS has been appointed purchasing agent of the Denver & Salt Lake with headquarters at Denver, Colo., succeeding A. A. Dawley, who has been assigned to some other duties.

IN MILITARY SERVICE

P. W. ELMORE, draftsman on the northwest district, western lines, of the Baltimore & Ohio, and J. D. STEMM, draftsman on the southwest district, with headquarters at Cincinnati, Ohio, have entered the Second Officers' Training Camp at Ft. Benjamin Harrison, Indianapolis, Ind.

R. W. GILMORE, assistant engineer of the northwest district, western lines, of the Baltimore & Ohio, has received an appointment to the Second Officers' Training Camp at Ft. Benjamin Harrison, Indianapolis, Ind.

F. A. BUSSE has resigned as bridge engineer of the Louisville & Nashville, with headquarters at Louisville, Ky., to enter military service as captain in the Engineer Officers' Reserve Corps, United States Army.

J. DE N. MCCOMB, office engineer of the Atchison, Topeka & Santa Fe at Chicago, has been commissioned captain in the Engineer Officers' Reserve Corps, and has been assigned to duty at Ft. Leavenworth, Kan.

L. P. LEBRON, assistant engineer of the Ft. Smith & Western, with headquarters at Ft. Smith, Ark., has been given an indefinite leave of absence, to enter military service as a captain in the Officers' Reserve Corps.

J. W. REID, bridge engineer of the Chicago & Alton, Chicago, and R. A. COOK, valuation engineer of the same company, who were commissioned captains in the Engineers' Officers' Corps, have been assigned to duty at Ft. Leavenworth, Kan.

J. R. JACKSON, assistant engineer of tests on the Atchison, Topeka & Santa Fe with headquarters at Chicago, has received a commission as captain of ordnance in the Officers' Reserve Corps, but has not yet been assigned to active duty.

T. M. WARD, engineer of bridges and buildings of the Seward division of the Alaska Government Railways, who has been commissioned captain in the Engineer Officers' Reserve Corps, has been assigned to active duty at the Cantonment at American Lake, Wash.

C. W. COCHRAN, who resigned as engineer maintenance of way on the Cleveland, Cincinnati, Chicago & St. Louis last March, has received a commission as captain in the Engineer Officers' Reserve Corps, and is serving on the staff of the chief engineer, Director General of Railways Department, U. S. Army, at Washington, D. C.

P. TOPPING AND E. WELLS, assistant engineers on the St. Louis-San Francisco with headquarters at St. Louis, Mo., have received commissions at captain and first lieutenant, respectively, in the Engineer Officers' Reserve Corps. Captain Topping has been assigned to the Fifth Engineers, United States Army, and Lieutenant Wells has been detailed to service at Ft. Leavenworth, Kan.

OBITUARY

WALTER GASKIN, scale inspector of the Southern Pacific at West Oakland, Cal., died on August 29.

WILLIAM H. ARNOLD, terminal engineer of the Lehigh Valley, with headquarters at New York, died on August 13 at the age of 53 years. Mr. Arnold entered the employ of the Lehigh Valley in January, 1914, and was terminal engineer at New York in charge of the new ore dock at Constable Hook, N. J., and the piers, pier sheds and dredging in New York harbor and at Perth Amboy, N. J.

CHARLES L. CRANDALL, professor emeritus at Cornell University, with which he was associated for nearly 50 years, died at his home at Ithaca, N. Y., on August 25. While active in many branches of civil engineering, he specialized in railway work and was well known among railway engineers as a teacher and as an author of several text and handbooks treating on various railway engineering subjects, including transition curves, earth-work tables, railroad surveying and railroad construction. He was a member of the American Railway Engineering Association, taking an active part in the work, particularly that of the committee on Iron and Steel Structures. Professor Crandall was born at Bridgewater, N. Y., in July, 1850, and entered Cornell University when that institution was opened, graduating with the first regular class in 1872. After two years of engineering experience he returned to the institution and was made a member of the instructional force, with which he continued until his death, serving in turn as instructor, assistant professor, professor of railway engineering and for the last two years as professor emeritus.

CONSTRUCTION NEWS

THE APACHE RAILWAY is completing surveys for a line from Holbrook, Ariz., to White River, by way of Snowflake, Shumway, Lakeside and Pinetop, a distance of about 71 miles, which taps the White Mountain timber belt and the Apache Indian Reservation. The work involves about 13,000 cu. yds. of grading per mile. The maximum grade will be $1\frac{1}{2}$ per cent and the curvature 6 deg. Grading work will be started soon and it is planned to have the road in operation within a year.

THE CANADIAN PACIFIC is enlarging the capacity of its West Toronto yards from 1,700 to 2,200 cars and revising the layout to avoid congestion. The Runnymede Road subway running through the center of the yard which now has a 6-track steel superstructure is being extended to carry 12 tracks. All grading and track work is being done by company forces, while Archibald & Holmes, Ltd., Toronto, are building the subway superstructure.

This company has also started double tracking its line between Leaside and North Toronto, a distance of about 2 miles. The grading and track work being done by company forces. In connection with this work two single track steel viaducts, each about 400 ft. long, with a maximum height of about 100 ft. from base of rail to ground line, will be replaced by reinforced concrete construction. One will be replaced by a two-track structure, with the Dominion Construction Company, Ltd., Toronto, doing the work, while the other will be replaced by a three-track structure, Wells & Gray, Ltd., Toronto, having the contract for this work.

THE CHESAPEAKE & OHIO has awarded a contract to the Langhorne & Langhorne Company, Richmond, Va., to make additions to the yard at Russell, Ky. This work calls for about 800,000 cu. yd. of earth excavation.

THE CHICAGO GREAT WESTERN has awarded a contract to T. S. Leake & Co., Chicago, to construct an 11-stall roundhouse at Clarion, Iowa. The structure will replace a 14-stall building which was destroyed by fire last April.

THE DELAWARE & HUDSON is building a new line to be used as third track from Schenevus, N. Y., to Richmondville Summit, a distance of 12.59 miles. This is located on a new right of way not adjacent to the present right of way, as the line is being constructed on a maximum of 0.5 per cent grade compensated, and maximum curvature of four degrees, to be used as a north bound freight line on the Susquehanna division.

THE ESSEX TERMINAL has been authorized by the Dominion parliament to build a branch from the existing line near Ojibway, Ont., to Pelton, seven miles.

THE GREEN BAY & EASTERN will be built from Green Bay, Wis., through Manitowoc to Sheboygan, 80 miles. The work will involve the handling of about 9,000 cu. yd. of material per mile, the construction of four 65-ft. bridges, two 50-ft spans, two 30-ft. spans and a number of small pile trestles. The bridge work will involve the use of 1,500,000 ft. b. m. of fir timber, 500,000 lin. ft. of piling, 300 tons of steel and 2,000 cu. yd. of concrete. The maximum grade will be 1.5 per cent and the maximum curvature 6 deg. Steam motive power will be used on the line for handling freight and gasoline electric cars for passenger and express service.

THE GREAT NORTHERN is contemplating the construction of a cut-off from the Willmar (Minn.) line to the Fridley terminals. No work is being done on the project at present, and none will be done in the immediate future.

THE ILLINOIS CENTRAL has called for bids for the construction of a four-track concrete bridge at Kankakee, Ill. The structure will be about 570 ft. long with six arches, five of which will be 90 ft. long and the other one 60 ft.

THE INDIANA HARBOR BELT has completed plans for the rebuilding of its I. C. I. transfer station at Gibson, Ind., which was recently destroyed by fire. The cost of the building will be about \$75,000 and the work will be completed about October 1.

THE KANAWHA & MICHIGAN through the Gauley & Eastern is building from Gauley Bridge, W. Va., along the west bank of Gauley river to Belva in Fayette county on the Kanawha & West Virginia, a distance of 5.6 miles. The track laying and bridge work will be carried out by company forces, while J. B. Lindsay, Littleport, Ohio, has the contract for the grading, which will involve the handling of 35,000 cu. yd. to the mile, three-quarters of which will be rock work. The line is being built to carry coal and lumber.

THE MISSOURI, KANSAS & TEXAS plans to construct a new main line about two miles in length around the east side of its present yard at Muskogee, Okla., and a 2,500-ft. second main track out of the station. The yard tracks will also be rearranged, the total improvements costing about \$80,000.

THE NEW YORK CENTRAL has awarded a contract to the Eastern Concrete Steel Company, Buffalo, N. Y., to construct a building at Curtis, street, Buffalo, to be used by the American Express Company as a transfer station, for the consolidation of car shipments and for local service, with offices on the second floor. The building will be two stories high, 60 ft. wide and 500 ft. long, of reinforced concrete construction, including platforms and canopies.

THE NEW YORK, NEW HAVEN & HARTFORD has awarded a contract to the Central Construction Company, Roxbury, Mass., for foundation work, and one to the American Bridge Company, New York, for the steel superstructure for bridges to be built in connection with the work of widening the present two-track South Boston cut to accommodate four tracks. The cut is about one-half mile long and the work is so involved with operation that the larger part of it will be carried out by company forces. The improvements call for 120,000 cu. yd. of excavation and the construction of 20,000 cu. yd. of masonry; the total cost of which will be about \$1,000,000.

This road has started company work in preparation for the new brick station to be built at New Haven, Conn. The building will 90 ft. wide by 300 ft. long and will face Union avenue. The main waiting room is to be 80 ft. wide and 136 ft. long, while a part of the second story will be used as a dining room and the rest for offices.

THE NORTHERN PACIFIC has awarded a contract to the E. J. Rounds Construction Company, Seattle, Wash., to construct a depot at American Lake, Wash., which will cost about \$12,000. The building will be 300 ft. long, 30 ft. wide and one story high, with concrete foundation and frame superstructure.

This company has also completed a reclamation plant at South Tacoma, Wash., which cost approximately \$60,000. The plant includes two scrap platforms each 50 by 600 ft. and three working sheds each 50 ft. by 100 ft., which are equipped with rolls for making the smaller sizes of round and square bars, and machines for the manufacture of bolts, etc., from scrap material.

THE PACIFIC ELECTRIC has completed plans for the construction of 12 one and two-story buildings of steel and concrete at Torrance, Cal., the total cost of which will be about \$1,200,000.

This company is making several improvements at the Macy street yards at Los Angeles, Cal. The work includes the construction of a car inspection house 246 ft. by 85 ft., with six pit tracks; a car repair shop 160 ft. by 150 ft.; a two-story trainmen's building 32 ft. by 82 ft., containing instruction room, locker room, offices, etc., and a storehouse 22 ft. by 25 ft. The total cost of the buildings will approximate \$151,000.

THE TEXAS ELECTRIC COMPANY is constructing two single-track extensions from Waco, Tex., to Camp Arthur, about five miles, to cost approximately \$60,000. The company expects to have the line completed by September 15.

THE WISCONSIN INTERURBAN has awarded a contract to J. T. Adams, Columbus, Ohio, for the construction of a line from Madison, Wis., to Janesville, a distance of 40 miles. The road will have a maximum grade of $1\frac{1}{2}$ per cent and maximum curvature of 6 deg. The work will involve about 15,000 cu. yd. of grading per mile, and the construction of several pile bridges, sub-stations, car barns, freight and passenger stations. In addition to the Janesville branch the company is planning the construction of a line from Madison to Fond du Lac.

SUPPLY TRADE NEWS

GENERAL

THE RAILWAY SPECIALTIES CORPORATION has moved its office to larger quarters at 30 Church street, New York.

THE ROBINSON PAINT COMPANY, Aurora, Ill., announces that it has purchased the plant, business and good will of the Akron Mining, Milling & Manufacturing Company. The business will be continued along the same general lines as heretofore, with the same organization.

THE HOLLOW TILE BUILDING ASSOCIATION, an organization composed of manufacturers representing 90 per cent of the total production of this burned clay product, has opened an office in the Conway Building, Chicago. E. R. Sturtevant, who has been engaged in the manufacture of hollow tile, has been elected secretary and treasurer and will devote his entire time to furthering the interests of the association.

THE RANSOME CONCRETE MACHINERY COMPANY of New York has been reorganized and reincorporated as a new corporation with larger capitalization, which has taken over the old company. It will enlarge and expand the business to include the entire line of building construction equipment, construction machinery, etc. Frank L. Brown is president, and John D. Givens is treasurer.

THE MCCARTHY DRILL & TOOL CORPORATION, Toledo, Ohio, with executive offices at 30 Church street, New York, has purchased the Toledo Drill & Tool Company, Toledo. This company has just moved into a new and enlarged fireproof two-story structure, where it has arranged to turn out large quantities of high-speed drills, in addition to a full line of cutters and reamers.

THE TITANIUM ALLOY MANUFACTURING COMPANY announces that because of the increased demand for superior bronze and brass castings it has become necessary to enlarge its bronze department and make a distinct unit of it under the name of the Titanium Bronze Company, Inc. The company's works are at Niagara Falls, N. Y., its sales offices at Buffalo and its general offices at 165 Broadway, New York.

THE STANDARD ASPHALT & REFINING COMPANY, 208 South La Salle St., Chicago, has purchased the plant, trade-mark and good will of the Sarco Petroleum Products Company. The Cities Service Company, 60 Wall Street, New York, is the new interest in back of the company, although the management will be essentially the same as before the change. Charles Muller, who was an executive of the former company, has been appointed manager and Robert S. Trumbull has been promoted to the position of manager of the railway and building materials department.

PERSONAL

CHARLES V. EADES, sales manager and engineer of the Sarco Asphalt Products department of the Sarco Petroleum Products Company, Chicago, for the past eight years, has left the service of that company.

J. H. JOWETT, general sales manager of the Ingersoll-Rand Company, at New York, has been elected vice president, with headquarters at the same place. He is succeeded as general sales manager by J. D. ALBIN.

L. L. HOLMES, formerly purchasing agent of the Chicago, Indianapolis & Western at Indianapolis, Ind., has been appointed railroad representative of the Barrett Company, New York, with headquarters at Boston, Mass.

A. W. RANSOME, who for nearly 20 years has been engaged in the development and manufacture of concrete machinery, has been appointed to the position of manager and chief engineer of the mixer department of the Blaw-Knox Company, Pittsburgh, Pa., which has taken up the manufacture of concrete machinery, developed during the past two years through the efforts of Mr. Ransome.

CHARLES M. TERRY, president of Charles M. Terry, Inc., has arrived in New York from Australia and will be located temporarily at 23-25 Beaver street. This company exports machinery and railway and engineering supplies.

JAMES P. BECK, general manager of the Portland Cement Association, Chicago, died September 8, in that city. He was born at Odell, Ill., January 27, 1886, and graduated from the University of Illinois in 1907. He entered the employ of the Universal Portland Cement Company the same year and two years later was made publicity manager. He was later prominently identified with the conduct of shows of the Cement Products Exhibition Company and in 1915 prepared plans for broadening the scope of the work of the Association of American Portland Cement Manufacturers. When his plans were adopted in the same year, he was made general manager of the association.

H. J. RICHARDSON, formerly manager of the gage department of the New England Westinghouse Company, has been appointed works engineer for the Berger Manufacturing Company, Canton, Ohio. His new work includes the power plant, new constructions, maintenance and repair of manufacturing equipment and buildings. Previous to his connection with the New England Westinghouse Company, Mr. Richardson was acting chief engineer of the ordnance department of the Crucible Steel Company, Harrison, N. J., and prior to that he was with the Commonwealth Edison Company of Chicago, the last seven years of this service having been in the engineering department.

LEWIS S. LOUER, western manager of Sweet's Catalogue Service, Chicago, has purchased a half interest in Engineering and Contracting, Chicago, and has assumed the business management of this publication, sharing the ownership with Halbert P. Gillette, who remains chief editor. Mr. Louer has been in the technical publication field since 1895, when he first became connected with the advertising service department of the Engineering and Mining Journal. He was advertising manager of Cassier's Magazine from 1896 to 1902, when he became western manager of the Engineering Record. After ten years' service with that company he resigned to become western manager of Sweet's Catalogue Service.

EDWARD SMITH has been promoted to chief draftsman in the Philadelphia office of the Austin Company, structural engineers, Cleveland, Ohio. Mr. Smith was born near Finleyville, Pa., on December 8, 1873, and graduated from Pennsylvania State College in 1893. He began his business career as a draftsman with the Keystone Bridge Works in 1896, and was later associated with the Fort Pitt Bridge Works and the American Bridge Company at Pittsburgh, Pa. In 1905, he became structural engineer of the Pittsburgh Railways Company in the construction of the Cannonsburg branch. Several years later he became associated with the Wheeling & Lake Erie as assistant engineer in the Cleveland office, which position he held until he went with the Austin Company.

H. E. HILTS, district engineer at San Francisco, for the Portland Cement Association of Chicago, has been elected general manager with headquarters at Chicago, succeeding J. T. Beck, deceased. Mr. Hilts was born in New York and received his engineering education at the University of Pennsylvania. He began his business career with the Mexican International as a rodman and later became associated with the Philadelphia & Western. For two years he was instructor in the engineering department of the University of Pennsylvania, from which position he entered the service of the New York Central, where he remained until 1913. On the latter date he became road engineer of the Portland Cement Association and in 1915, was appointed district engineer at San Francisco, which position he held until his recent promotion.

TRADE PUBLICATIONS

SCREWS.—The F. C. Harper Screw Works, Chicago, Ill., has issued a catalogue and price list containing detailed data on cap, set, machine and lag screws; castellated and plain nuts; stove, machine and carriage bolts; lock and plain washers; pipe, cotter and taper pins; and rivets. The information is tabulated in a form that makes it easy for reference.

Mudge & Company

Railroad  *Specialties*

Burton W. Mudge
President
Robert D. Sinclair
Vice-President
William B. Ross
Secretary and Treasurer

Railway Exchange
Chicago

September
Nineteenth
1917

Karl J. Eklund
Assistant to President
Herbert Deeming
Sales Manager
Jean K. Vanatta
Mechanical Engineer

Dear Mr. Deeming:

At the Roadmasters' Convention this year, where we exhibited one of our Class E-6 "Safety First" Inspection Motor Cars, it was gratifying to note the interest those in attendance displayed in this "load-in-the-middle" type of car. The feeling seemed to prevail that Mudge "Safety First" cars would, in an advanced manner, successfully satisfy every inspection requirement.

The Roadmasters' problems are growing more acute each succeeding year and I believe they appreciate what we have done in this instance to relieve them.

We should emphasize the good features illustrated in the four views which accompany this memorandum, because each one tells an interesting story to the practical Roadmaster.

No. 1 shows how easily the car is handled on and off the track by one man.

No. 2 shows the car being started. A three-stride push and it is in splendid operation. Note how easy it is to mount, and the absolute lack of danger in jumping aboard.

In No. 3 the car is seen running down the track operating on kerosene. This picture brings out the center-hung feature; it shows how the seat board and low hung weight is evenly balanced between all four wheels.

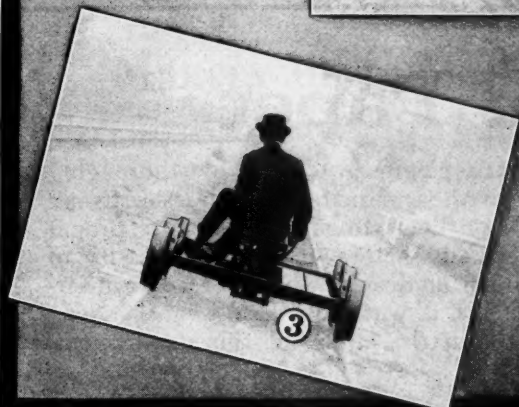
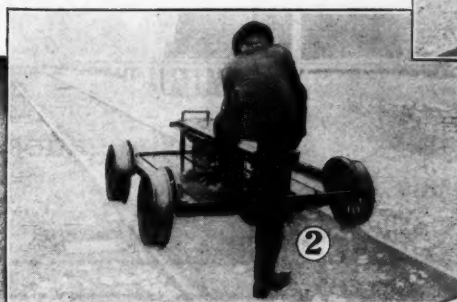
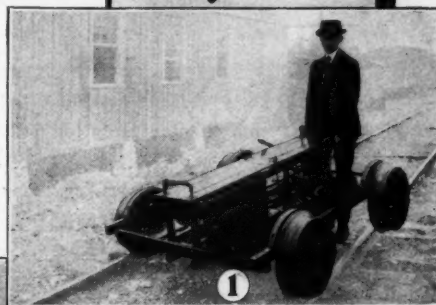
The close-up view in the illustration marked No. 4 shows ample room on the seat board and plenty of loading space on platform. Control levers, brake, also grab irons and safety side rails are handy.

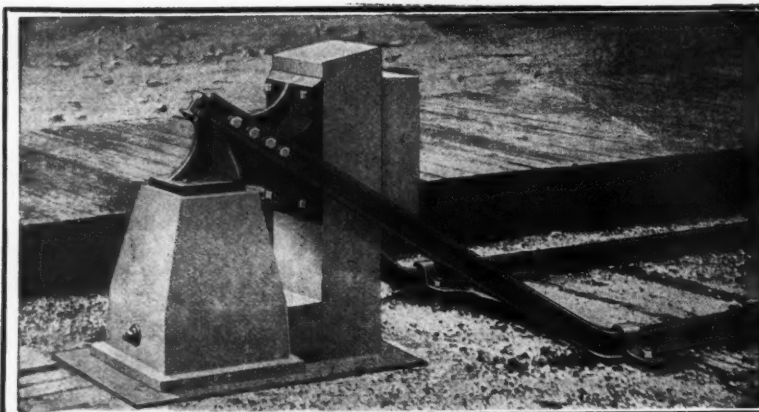
This car is its own recommendation and wherever it is in operation the men are enthusiastic about it because of the safety features.

Every Roadmaster should know about this car.

Mudge

**Motor Car
Safety
for Your
Roadmasters
Supervisors
B&B Foremen
Valuation men
Signal men
Line men
Claim Adjustors
Patrolmen
Inspectors**

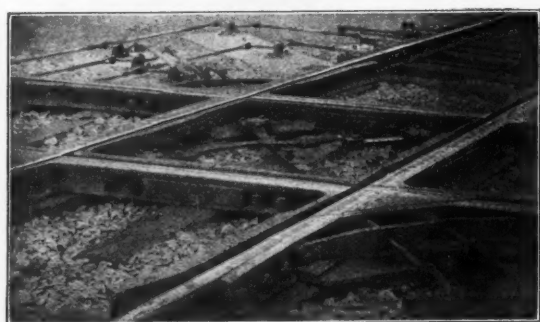




ELLIS PATENT **Bumping Post**

**Simple, Strong and Lasting
Adapted to All Positions**

Mechanical Manufacturing Co.
Chicago, Ill.



The Real Test

of a crossing is its ability not only to stand up under all conditions of service at a low maintenance cost, but also at the same time to stay in such condition that an early renewal will not be necessary. Several years' continuous service show that the

Eymon Continuous Crossing

fulfills the above conditions. It provides smooth rails and eliminates the cause of the pound. It reduces the maintenance costs—it does not get out of alignment and provides greater safety to both rails and equipment. Write for the facts.

Eymon Continuous Crossing Co.
MARION, OHIO.

KILBY FROG & SWITCH COMPANY

Birmingham, Alabama

Manufacturers of

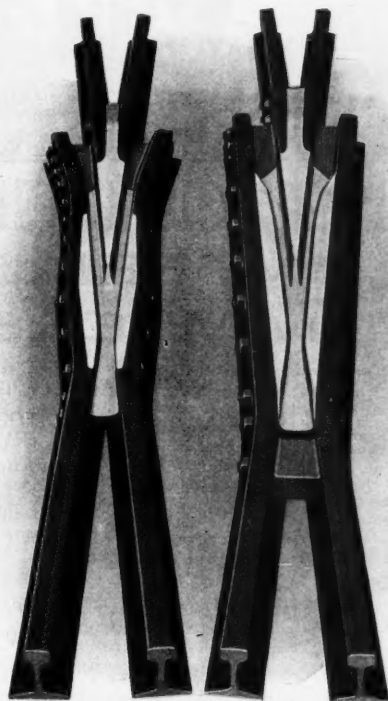
**Frogs, Switches,
Crossings, Etc.**

**Manganese Track Work
a Specialty**

A Balanced Paper

Have you ever studied the Railway Maintenance Engineer to see how thoroughly it covers its field? Special attention is given to the balancing of each issue to see that every branch of the Maintenance of Way Department is given its proper attention and space. The editors have continually before them the necessity of presenting in each issue information which will be of direct value to readers interested in the different phases of this work. This is what is making the Railway Maintenance Engineer such an important factor in the affairs of this department.

TISCO Manganese Steel



Wharton A-91 Frog

M.T.S. Standard Frog

Showing You How the M.T.S. Standard Rail-Bound Manganese Frog

Compares with a type of frog which has been quite popular for many years and used very extensively—our Design A-91.

Note the much more generous proportions of the Manganese Steel casting in the M.T.S. Frog; added strength through wing rails not being notched to receive casting; absence of strain on bolts due to casting containing guard flares, and more of the throat; heavier heel-block extension; general straight lines throughout, facilitating accuracy in fitting.

Adopt the **M.T.S.** as Standard

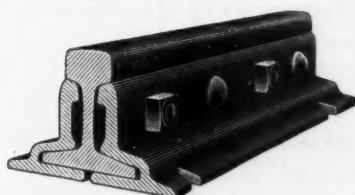
Detail drawings of the M.T.S. Frog, of any standard angle, from No. 4 to No. 20, gladly furnished upon request.

Manufactured by

Wm. Wharton Jr. & Co., Incorp.
EASTON, PENNA.

THE RAIL JOINT CO.

General Offices, 61 Broadway, New York City



Continuous Rail Joint

Makers of Continuous, Weber, Wolhaupter
and 100% Rail Joints

Standard—Insulated—Step—Frog and Switch Types

Grand Prize San Francisco 1915

PROTECTED BY PATENTS

Introducing
The
Railroad Department

of the
Joseph Dixon Crucible Co.

We respectfully solicit your correspondence pertaining to graphite productions and their uses.

DIXON'S PRODUCTS
FOR THE
RAILROAD

Dixon's Silica-Graphite Paint
Dixon's Air Brake Graphite for Triple Valve Lubrication
Dixon's No. 635 Special Graphite for Air Pump Lubrication
Dixon's Fine Flake Graphite for Steam Cylinder Lubrication
Dixon's Boiler Graphite
Dixon's Graphite Pipe Joint Compound
Dixon's Graphite Engine Front Facings
Dixon's Graphite Curve Grease
Dixon's Graphite Center Plate Compound
Dixon's Graphite Gear Grease
Dixon's Graphite Waterproof Grease
Dixon's Graphite Ferry Rack Grease
Dixon's Graphite Signal Grease No. 677
Dixon's Graphite Cup Grease (soft, medium, hard)
Dixon's Graphite Foundry Facings
Dixon's Graphite Crucibles
Dixon's Graphite Furnace Linings
Dixon's Pencils and Crayons

Made in JERSEY CITY, N. J., by the
Joseph Dixon Crucible Co.
Established 1827



**"IMPERIAL"
TAMPERS**

are working on the
Lehigh Valley Railroad

This and the many other lines which have equipped their maintenance force with "Imperial" pneumatic tamping find that they are saving money.

Track is resurfaced at a much faster pace, with fewer workmen.

Track stands up better, needs less frequent tamping.

Switches, crossovers, etc., create no interference; "Imperial" Tampers work at full speed where bar or shovel tamping is an impossibility.

PLAN NOW for NEXT SPRING

You will need "Imperial" Tampers more than ever—and more "Imperial" Tampers than ever.

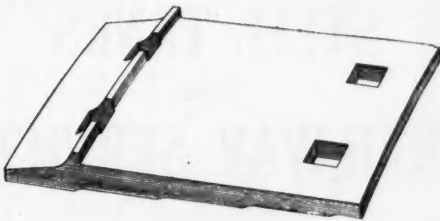
Bulletin 9023

Ingersoll-Rand Company
11 Broadway, New York

When at the Chicago Convention
Watch "IMPERIAL" Tampers at Work
SPACE 20



72-TT



THE LUNDIE TIE PLATE

The Lundie Tie Plate is widely acknowledged by railroad men having such plates in track, as promoting decided economy in rail wear, in holding track to gauge and in giving easy riding track. It will far more than pay for itself in reduction of Operating Expenses.

The features of the plate are—a sloping seat inclining the rail, so reducing abrasion and internal stresses in the rail to a minimum—a true camber promoting easy riding—and a bottom, as shown in the cut, so seating itself on the tie that the track is held firmly to gauge without injury to the tie.

The combination of these features, or their mechanical equivalent, is covered by Letters Patent, supported by other Patents covering certain individual features of the plate. Railroad companies pay no royalties on its authorized use.

The undersigned, as the original promoter of the principles embodied in the Lundie Tie Plate, offers plates for sale in fair competition with any other plate in the market, depending on its proven merits for its extended use.

JOHN LUNDIE, 52 Broadway, NEW YORK



Doing Your Bit—

—these days and each man increasing his own efficiency is made easier by the use of

Toledo Pipe Threaders

Thousands of "Toledos" are in use in Government Army Camps, Navy Yards and the battleships. A complete equipment of "Toledos" will accompany the Division of U. S. A. Railroad Engineers to France. Everywhere pipe must be threaded, Uncle Sam is specifying "Toledos," for he has used them on government jobs for years and knows he can depend on them to produce results.

You will find "Toledos" just as efficient as the government officers are. Ask us for a copy of the "Toledo" Hand Book.

THE TOLEDO PIPE THREADING MACHINE CO. TOLEDO, OHIO

**NEW YORK OFFICE, 50 CHURCH ST.
349 HUDSON TERMINAL**



Capacity, 60,000 gallons. Height, 36 ft. 8 in. to top.

STEEL RAILWAY SERVICE TANKS

OR

PERMANENCE AND NEGLIGIBLE MAINTENANCE COST

WRITE FOR RAILWAY BOOKLET NO. 28

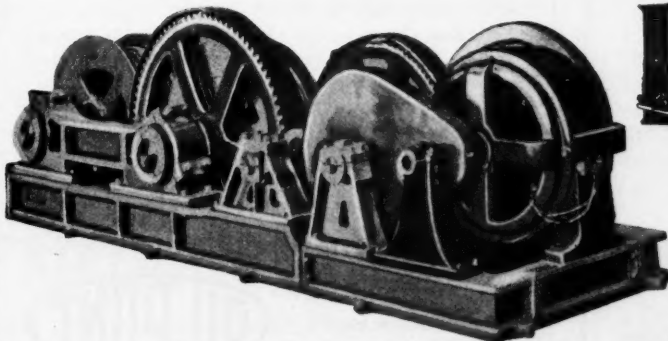
We manufacture and erect Elevated Steel Tanks and Standpipes for every service

Des Moines Bridge & Iron Co.

Des Moines, Iowa, 912 Tuttle St.

Pittsburgh-Des Moines Steel Co.

Pittsburgh, Pa., 920 Curry Building. New York City, 55 Church St. San Francisco, Cal., 5000 Rialto Building. Chicago, Ill., 1290 First National Bank Bldg. Havana, Cuba, Room 165 Nova Scotia Bank Building. Dallas, Texas, 1285 Praetorian Building. Chatham, Ont., 299 Innes Ave. Plants—Pittsburgh, Pa. Des Moines, Ia. Chatham, Ont.



All Hoists Built on Duplicate Part System

LIDGERWOOD CAR HAUL

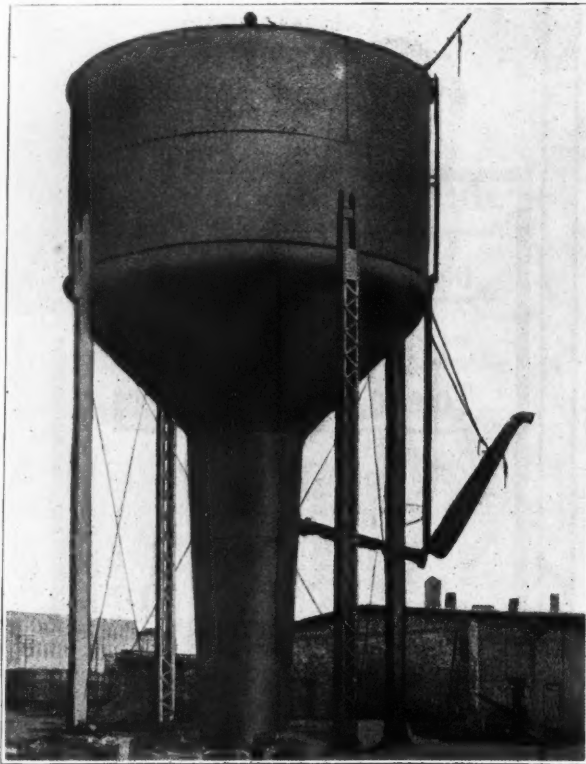
Endless Rope Electric Car Haul Hoist. Pull 17,500 lbs. at 75 F. P. M. Built for Pennsylvania R. R. Co.

We build hoists suitable for every character of railroad work

Write for Catalogues

Lidgerwood Mfg. Company
96 Liberty St., New York

Chicago Philadelphia Pittsburgh Seattle London, Eng.



Capacity 50,000 Gals. Height 20 Ft. to Bottom
Chicago & Northwestern Ry.

STEEL TANKS For RAILWAY SERVICE

Build For The Future

The Corporations which show the most enviable dividend record over a period of years are those which have followed this policy.

**A Steel Tank Is An Asset That Does
Credit To Your Judgment**

Chicago Bridge & Iron Works

SALES OFFICES

Chicago, Ill.
New York, N. Y.
Dallas, Tex.
Jacksonville, Fla.
Detroit, Mich.
Havana, Cuba

Charlotte, N. C.
Salt Lake City, Utah
Seattle, Wash.
Los Angeles, Cal.
San Francisco, Cal.
Bridgeburg, Ont.

SHOPS

Eastern: Greenville, Pa.
Pittsburgh, Pa.
Central: Chicago, Ill.
Canadian: Bridgeburg, Ont.

CABLE ADDRESS
"Chibridge Chicago"



SHERWIN-WILLIAMS

RAILWAY LINE

*Shortest Route to Best Results
A Paint Product for Every Railway Use*

Metalastic

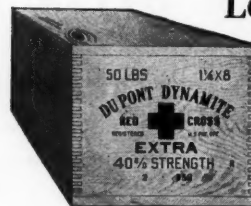
A perfectly balanced combination of Carbon, Graphite and Silica, ground in pure linseed oil. For the efficient protection of metal. Specify Metalastic. Black, Brown, Green, Gray. Dries hard enough to resist abrasion, yet remains elastic and flexible.

THE SHERWIN-WILLIAMS CO.

Railway Paint and Varnish Makers

Address Inquiries to

798 Canal Road, N. W. CLEVELAND, OHIO



**Load Bore Holes
With
Red Cross
Extra**
The
Universal Explosive

Red Cross Extra Dynamite is a LOW FREEZING, all-the-year-round, high efficiency explosive especially

Adapted to Contracting

It is made in all standard strengths from 20 to 60% and guaranteed to be as represented by cartridge markings.

Red Cross Extra Dynamites are as strong, stable and efficient as any other standard explosive.

If no test of Red Cross Extra has been made, make one at once—it is the least expensive and most efficient explosive.

Tell us what your blasting work is. Let us suggest efficient and economical ways to use Red Cross Explosives.

E. I. du Pont de Nemours & Co.

Wilmington, Del.

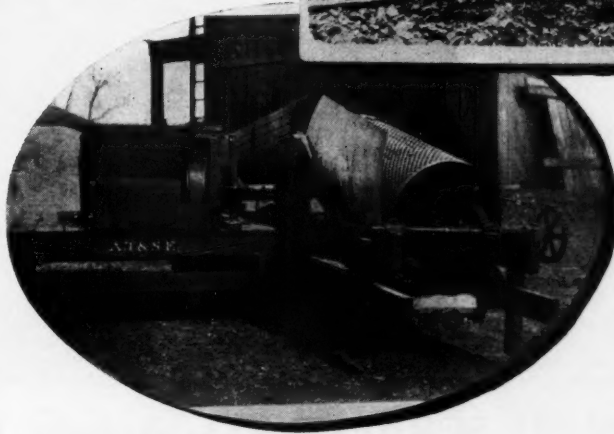
POWDER MAKERS

SINCE 1802



\$50⁰⁰**PER DAY****SAVED***By One Gang*

The Harris-Muff Ballast
Screening Machine in Operation.



**SCREENED 1,700 FEET
OF CRUSHED ROCK
BALLAST IN ONE DAY
AT A COST OF \$17.50.
THE OLD WAY COST
\$67.50.**

The FAIRMONT "Makes Good" On A New Job—Read The Letter

Chapman, Kans., July 21, 1917.

Fairmont Gas Engine & Railway Motor Car Co.,
Fairmont, Minn.

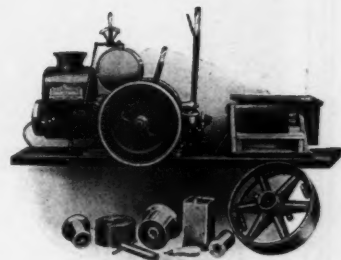
Dear Sirs:—I am enclosing two photos of a track screening machine I patented and which my FAIRMONT engine is running.

Recently I ran the machine all one day (TEN HOURS) WITHOUT A STOP on four gallons of gasoline. In this time the machine screened 1,700 ft. of crushed rock ballast at a total cost of only \$17.50. Another gang (working without the machine) only screened 1,400 ft. at a cost of \$67.50 for labor—just \$50.00 more than it cost to do the same work and three hundred feet besides with the machine.

I have never seen another engine on this work run for ten hours without a stop. I don't think we would have done so well without the MIGHTY FAIRMONT.

Yours truly,

(Signed) G. C. HARRIS, Sec. Foreman.



This is the little engine
whose middle name is POWER

NOTE:—Mr. Harris has recently ordered his second FAIRMONT engine, having sold his first one after it had been in constant service for four years. The engine is still in good working order.

FAIRMONT GAS ENGINE & RY. MOTOR CAR CO.

423 N. Main Street,

FAIRMONT, MINNESOTA, U. S. A

You've Got a Job for Every Man Replaced by Western Air Dump Cars

Every "man-day" you save in ditching and filling can be used wherever there is a scarcity of men for other work. Such a large number of men are replaced by Western equipment that it is most essential to present day economy.

The great loads that Western Dump Cars carry; the high speed at which they may be run; and the almost instantaneous dumping are points of superiority over other equipment which make their economy in use obvious.

If there is work ahead of you, where Western Air Dump Cars will save men, money and time, you should not hesitate to get them. Every means of gaining greater efficiency is going to help your road and also your country in its need of man power.

You will find, in our catalogue, equipment which will show economy over the way you are now handling earth and stone. Get a copy and look it over thoroughly.



WESTERN WHEELED SCRAPER CO., Aurora, Illinois



Marion
Steam Shovels, Dredges, Draglines
and Kindred Machinery

THE Puget Sound & Cascade Railway Company, Clear Lake, Washington, use this Model 31 "Marion" for nearly everything that could be given a Shovel to do. And in the words of President B. R. Lewis, "I do not think there is a Shovel that could give better service"—adding that this "Marion" was used for

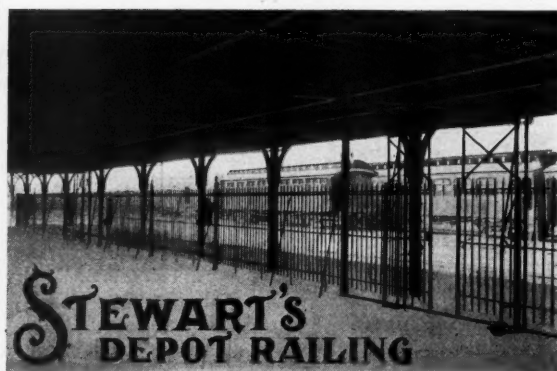
Digging, Ballasting, Cleaning Up Slides, Picking Up Timbers, Etc.

"Fifteen hundred yards of material in a single day" is one item in Mr. Lewis' report; another shows that with their "Marion" the Company cut ten miles of roadbed through hard, rocky material at one-fifth the previous cost of doing similar work by hand!

Now, Marion Shovels, Ditchers, Etc., enjoy this same good reputation with Railroads everywhere. Don't you want to get some facts on your own account? Our engineers will gladly supply them, if you will furnish the necessary particulars.

The Marion Steam Shovel Company, Marion, Ohio

Branches: Atlanta, Chicago, New York, Philadelphia, San Francisco, Seattle
ESTABLISHED 1864



For twenty-five years Stewart equipment has proved its superiority for Right of Way Fence, Inter-track Fence, Iron and Wire Window Guards, Baggage Room and concourse enclosures on every important railroad.

The oldest installations from the standpoint of strength, service and perfect appearance cannot be distinguished from the new.

The world's largest factory and finest reputation is behind

STEWART'S
IRON FENCE
"The Standard of the World"

A corps of designers who will gladly help you solve your fencing problem are at your immediate service.

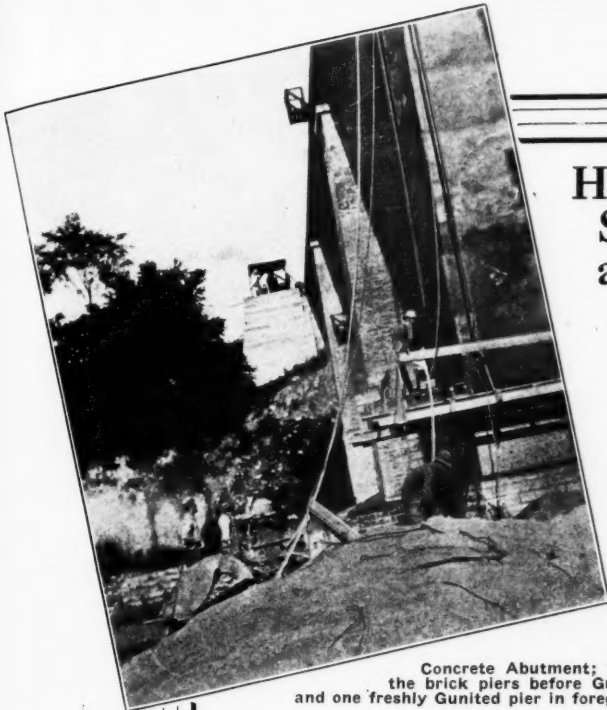
To make sure of quality iron, mechanical perfection, modern design and universal approval—investigate, specify and insist on Stewart's.

THE STEWART IRON WORKS CO.

700 Stewart Block

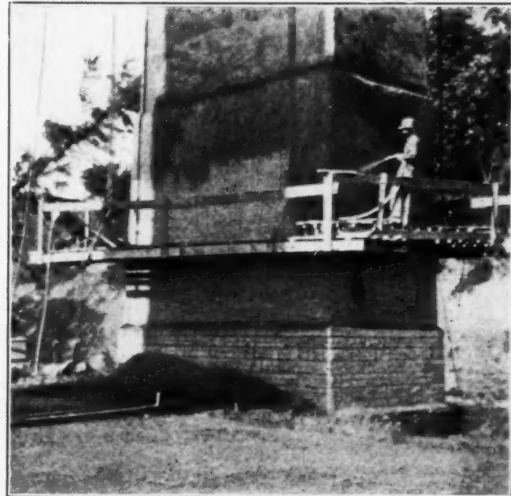
Cincinnati, Ohio

"World's greatest iron fence builders."



Concrete Abutment: Two of the brick piers before Guniting and one freshly Gunited pier in foreground.

How the G. T. Ry. Saved the old Bridge at Weston, Ontario, Can.



Nozzleman at work on brick pier coating it with Gunite.

SIXTY-THREE years ago they built the Grand Trunk Railway Bridge across the Humber River. Brick piers and abutments, good honest design and construction, and, "there is a bridge for service," said the railroad men and citizens of 1854.

Time passed, and in passing touched that bridge at Weston, and recently its brick piers and abutments showed signs of serious disintegration.

About a year ago, down came one of the abutments to be rebuilt of reinforced concrete. It looked as if the old bridge must go, but more—it looked like an expensive job. Then the field gun of general railway utility was trained upon that bridge at Weston. "Fire," said the engineer of bridges and buildings, and from the

CEMENT - GUN

there shot a stream of that product which defies the elements—GUNITÉ. Handled by a crew of five men—men inexperienced in handling the Cement-Gun, without constructing expensive falsework, or delay, the abutment and the eight piers were coated with three thousand square yards of Gunite at an approximate cost of 47 cents per square yard.

That's how the G. T. Ry. saved the old bridge at Weston, and more—saved the expenditure of a large sum for reconstruction.

Yesterday it was "Something New in Battery Vaults," today it is something old made as good as new. Every day, it is problems solved, and time and money saved to the railroads by having

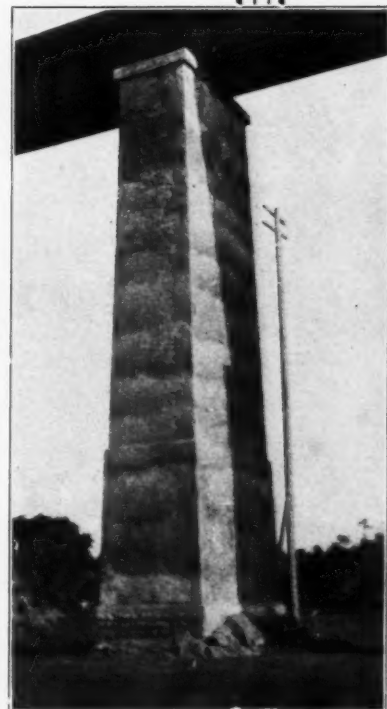
A Cement-Gun for Every Division

Proof! Yes, all the proof you want concerning the service of this gun, which is not a restricted article; which can be bought and used by any one and which is needed on every division of every railway, yours included.

Cement-Gun Co., Inc.,
Allentown, Pa.

New York Office, 30 Church Street

E. R. Ayers, 1414 Fisher Bldg., Chicago, Ill.; John A. Traylor, Newhouse Bldg., Salt Lake City, Utah; Taylor Engineering Co., 538 Central Bldg., Seattle, Wash.; Taylor Engineering Co., Vancouver, B. C.



One of the piers of the old bridge after Guniting.

The Buyer's Interest in Wasteless Advertising

BUYERS who appreciate that waste in selling must eventually be passed on to them in some form are paying more and more attention to the sales methods of the concerns seeking their business.

The extravagant use of space in publications of general circulation to advertise a commodity or a service appealing chiefly to a certain well-defined class, is not only poor judgment, but *it is an economic waste.*

Can you imagine an intelligent salesman, with a proposition for a steel mill or a dry goods store, calling at every office in town in an effort to locate a prospect? How needlessly wasteful to adopt similar methods in advertising, which is simply an improved means of accomplishing certain necessary steps of a sale.

On the other hand, the seller who uses the business papers reaching *only* the class interested in his message, is employing the most direct, efficient and economical method of getting in touch with prospective buyers.

Properly used, the good business paper bears the same relation to the sales department that an improved machine does to the production department. Better selling methods go hand in hand with better manufacturing methods.

To encourage wasteless advertising, the most efficient modern means of bringing buyer and seller together, there is every reason why the discriminating buyer should give preferred consideration to the concern that tells its business story in the buyer's own business paper.

Ask this office anything you want to know about Business Papers or Business Paper Advertising.

THE ASSOCIATED BUSINESS PAPERS · INC.

The International Organization of Trade,
Technical and Class Publications

Headquarters, 220 West 42nd Street
New York

LIST OF MEMBERS

Each member has subscribed to the 10 "Standards of Practice," a high code of ethics covering all departments of business paper publishing.

Advertising & Selling
American Architect
American Blacksmith
American Exporter
American Hatter
American Machinist
American Paint & Oil Dealer
American Printer
American School Board Journal
Architectural Record
Automobile, The
Automobile Dealer & Repairer
Aviation & Aeronautical Engineering
Boot & Shoe Recorder
Brick & Clay Record
Buildings & Building Management
Bulletin of Pharmacy
Canadian Grocer
Canadian Railway & Marine World
Cement World
Clothier & Furnisher
Coal Age
Concrete
Domestic Engineering
Drygoodsman, The
Dry Goods Economist
Dry Goods Reporter
Editor & Publisher
Electrical Review & Western Electrician
Electrical World
Electric Railway Journal
Electric Traction
Engineering & Mining Journal
Engineering News-Record
Farm Machinery—Farm Power
Furniture Manufacturer & Artisan
Grand Rapids Furniture Record
Haberdasher, The
Hardware Age
Hide & Leather
Hotel Monthly
Illustrated Milliner
Implement Age
Industrial Arts Magazine
Inland Printer
Iron Age
International Trade
Lumber Trade Journal
Lumber World Review
Manufacturing Jeweler
Marine Engineering
Metal Worker, Plumber & Steam Fitter
Metallurgical & Chemical Engineering
Modern Hospital
Motor Age
Motor World
National Builder
National Druggist
National Petroleum News
Power
Practical Engineer
Railway Age Gazette
Railway Electrical Engineer
Railway Maintenance Engineer
Railway Mechanical Engineer
Railway Signal Engineer
Shoe & Leather Reporter
Shoe Findings
Shoe Retailer
Tea & Coffee Trade Journal
Textile World Journal
Transfer & Storage
Woodworker

